STREET CLEANING

IN THE

CITY OF NEW YORK,

1895, '96, '97.

SUPPLEMENT

TO

MUNICIPAL AFFAIRS.

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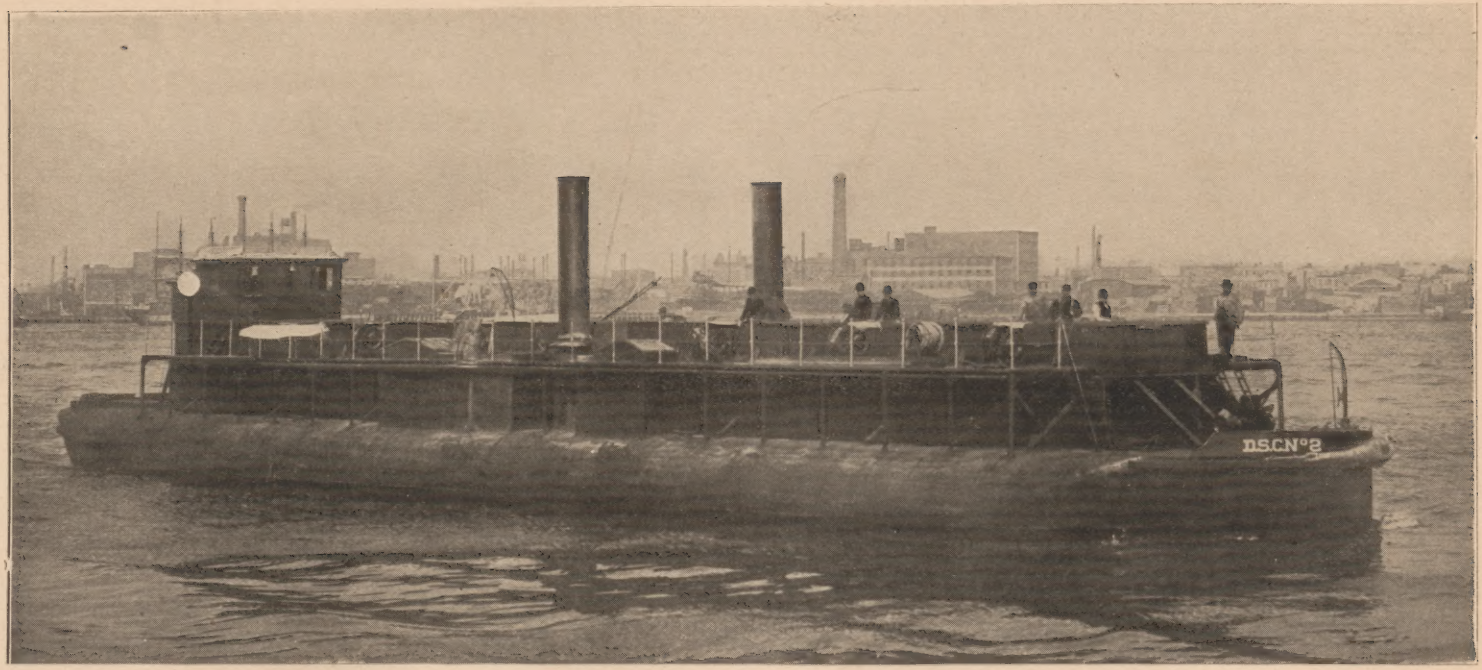
GEORGE E. WARING, JR.,

COMMISSIONER.

NEW YORK:
REFORM CLUB, COMMITTEE ON MUNICIPAL ADMINISTRATION,
52 WILLIAM STREET.

Per Year, $1.00. This Supplement, with or without June Number, 50 cents.

Entered at the Post Office at New York, and admitted for transmission through the mails, as second-class matter.



THE DELEHANTY AUTOMATIC DUMPING-BOAT "ASCHENBROEDEL"

The "Aschenbroedel" is a steel pontoon steamer carrying its cargo of ashes and street dirt in compartments (7) situated between the two pontoons. Dimensions: 140 feet over all; 33 feet beam; draught (light), 4½ feet; (loaded), 7½ feet; beam of pontoon (midship), 10 feet; depth of hold, 10 feet. Main engines: One in each pontoon, compound, surface condensing with two cranks at 90 degrees, 14 inches stroke, cylinders 12 and 24 inches diameter. Auxiliary apparatus: Circulating pump and engine, condenser, air pump, feed pumps (2), injectors (2), fire and bilge pump, bilge ejectors (2), ventilating engines (2), dynamo and hoisting engine operating gear controlling the cargo compartment doors. Boilers: One in each pontoon, marine water tubular, 250 H. P. rating. Propellers: 5 feet diameter, 7.5 feet pitch, giving at 160 revolutions per minute a speed of 8 miles per hour. Capacity: 400 tons of ashes.

The complete fleet of these steamboats is to consist of the "Cinderella," "Aschenbroedel," "Cenerentola," "Cendrillon" and "Asschepoester."

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LETTER TO THE MAYOR.

DEPARTMENT OF STREET CLEANING,
CITY OF NEW YORK, December 27, 1897.

To His Honor, WILLIAM L. STRONG,
Mayor:

SIR—I beg to submit for your consideration a final report of the observations on street cleaning methods in certain European cities, made by your direction, during August and September, 1896, and a report of the operations of the Department of Street Cleaning during the three years of your administration, relating especially to the modifications which have been made in the methods of the dumping and the final disposal of street sweepings, ashes, garbage and rubbish. Also the report of the Snow Inspector, which gives all that is known of the history of snow removal, together with a full account of this work during your administration. Finally, I submit for consideration a report of the operations of the "Committee of 41" and the "Board of Conference"—a dual organization for the establishment of better relations between the Commisioner and the men of the Department.

Special reference is made to the report of George L. Walker, Master Mechanic, concerning the operations of his Bureau, as relating to stables, picking-yards and storage dumps.

Also to the report of Charles A. Meade, Superintendent of Final Disposition, concerning, among other things, the construction and use of the Delehanty boats in connection with storage dumps, sea dumping and dumping at Riker's Island, and the disposal of rubbish, etc.

Also reports of Hawthorne Hill on the private collection of garbage, the garbage tankage trade, street sweepings as a fertilizer, and the traffic in waste paper.

Also the report of C. Herschel Koyl on the utilization of ashes, and his report on the principal factors governing the work and cost of street sweepings, etc. I ask your special attention to this report, which is accompanied by elaborate tables and computations, showing, as a conclusion, a theoretical result that is in very close conformity to the actual practice of the Department at the same period.

To this report there is appended a table, showing the results of actual measurements made by the District Superintendents and Foremen in the autumn of 1897, giving the square-yard area of asphalt, granite, Belgian, cobble, brick and wood pavements for each district and for the whole city, together with the total amount of daily sweepings.

Also the report of Macdonough Craven on the present condition of the Barren Island plant. Mr. Craven has for nearly the whole period of three years acted as scientific expert in the matter of garbage disposal, etc. His report is as follows :

"The first calendar year of separation, collection and disposition of garbage, which will be closed at the end of this month, shows the following record of cartloads of garbage collected by the Department carts :

Months.	Department Street Cleaning.	Permits.	Totals.
January	10,045	1,562½	11,607½
February	8,460	1,192¾	9,652¾
March	10,535½	1,720¼	12,255¾
April	11,890¾	1,645¼	13,536
May	15,153¼	1,505	16,658¼
June	17,103¼	1,780¾	18,884
July	17,241¼	1,873	19,114¼
August	16,291	1,572	17,863
September	16,371¼	1,596½	17,967¾
October	14,809¼	1,704½	16,513¾
November	13,052¾	1,825½	14,878¼
December*	13,369	1,405	14,774
Total	164,422¼	19,383	183,705¼

* The figures for this month are in part estimated.

"The cartloads have been determined to have an average weight in round numbers of 1,700 pounds. This gives a total of 156,150 tons of 2,000 pounds for the year 1897 disposed of under the contract with the Sanitary Utilization Company. The quantities actually handled by the Barren Island plant are in excess of this, as a large part of the annual output of Brooklyn was also disposed of in the same plant.

"The present condition of the Barren Island plant is such that no additions will be necessary in order to handle the output of garbage of the coming year that should be disposed of in accordance with the contract.

"The improvements of the past year have been such as to show conclusively the good intentions of those interested in the enterprise. A large evaporator has been added to the works; improved methods of unloading have been adopted; a better class of labor has been obtained; the resident superintendent is a man of energy and experience; a furnace for the utilization of the waste tins is in course of construction; the steam piping for cooking has been rearranged; a better system for the washing of noxious gases is in operation; additional precautions against a possible loss by fire, comprising a duplication of pumping machinery and improvements in construction, together with many changes of minor importance have been installed; and altogether the entire plant is in a very satisfactory condition. In addition to the above the quarters occupied by the workmen have been enlarged and improved in many ways, including the cuisine, and the adjacent grounds are constantly in course of improvement.

"Considering the fact that the plant was called on to handle a greater quantity of raw material than was at first anticipated * and the necessarily rapid construction that was forced on the contractors, it may be safely said that a better state of affairs could not be expected.

"During the past season the stress of work resulted in a requirement for many repairs which the plant is at present undergoing, and it is now being placed in proper condition for the rush of the coming heavy season.†

"There is one question that will require consideration, however, and that is transportation. The past year has been generally free from prolonged periods of adverse weather conditions such as would make the entrance to Jamaica Bay impassable, or that would otherwise prevent transportation to Barren Island. These weather conditions are at their worst during the winter months, when the garbage output is at its lowest point, and a delay of forty-eight hours in delivery would not, on account of the temperature, result in cause for complaint. Additional scows can also be readily procured at this season. The conditions, however, are antipodean if we consider the possibilities of delay during the summer months. At that time of year extra scows are

* The garbage from Brooklyn.

† There is, during the winter and early spring, about one-half the quantity of food waste that there is of the same waste in the last half of summer and the first half of autumn.

sometimes unavailable; and decomposition of the collected material is rapid and would soon become a nuisance; the plant, moreover, is worked to nearly its utmost capacity, and twenty-four hours' delay in delivery would result in an accumulation that would tax the powers of the machinery at the island to the utmost in an endeavor to regain the lost time. Such conditions do not always exist. The past summer was one of unprecedented activity in scowing, making extra scows out of the question for a long period.

"The completion of the usual winter repairs (slack season) will leave the works in thorough condition for the coming season as far as the garbage of the present city is concerned."

In addition to the foregoing, a very thorough investigation has been made, running over most of the past year, by Mr. Craven, Mr. Koyl and Mr. Joseph A. Shinn, of Pittsburg, looking to the possibility of developing a money value from the coal ashes of domestic fires. The following results have been reached, and I think that the conclusion to which they point may be regarded as sound.

We are now collecting about 800,000 loads of domestic ashes per annum, equal to 1,200,000 cubic yards. Repeated experimental analysis of these ashes indicates that they will yield, on the average :

Coal (recoverable)	20 per cent.
Clinker	15 per cent.
Fine ash	50 per cent.
Coarse ash and stone	15 per cent.

[Weight and bulk are approximately proportional.]

These percentages give :

	Net Tons.	Cubic Yards.
Coal	144,000	.....
Clinker	.....	180,000
Fine ash	.....	600,000
Coarse ash and stone	.....	180,000

A fair estimate of value of these materials is as follows :

Coal, 144,000 net tons, at $2.50, equals	$360,000 00
Clinker, 180,000 cubic yards, at 75 cents, equals	135,000 00
Fine ash, 600,000 cubic yards, at 28 cents, equals	168,000 00
Total value	$663,000 00

The cost of collection and delivery at the present dumps, based on Department wages, purchases, rentals, administration, etc., is, per cartload, 80 cents; per cubic yard, 53 cents—making the total cost of collection $640,000.

The cost of separating one cubic yard of ashes into its available parts is estimated at 12½ cents per cubic yard, or for the total output, $150,000.

The fine ash, when properly mixed with lime, makes a building mortar which has a greater tensile strength and a proportionately higher crushing strength, and is of much less specific gravity than sand mortar. Therefore, if the use of such mortar could be legalized, it should at least have as good or perhaps better sale than sand mortar. The cost of manufacture and delivery would be about $2.20 per cubic yard. Machine mixed sand mortar is selling in market for $3.45, delivered.

Respectfully submitted,

GEORGE E. WARING, Jr.,
Commissioner.

STREET-CLEANING IN EUROPE.

A REPORT OF OBSERVATIONS MADE IN THE SUMMER OF 1896

BY GEORGE E. WARING, JR.

COMMISSIONER OF STREET CLEANING, CITY OF NEW YORK.

The following is based on a personal examination of the street cleaning methods of Vienna, Budapest, Munich, Berlin, Cologne, Brussels, London, Birmingham, Paris, Turin and Genoa.

VIENNA.

The impression produced by the streets of Vienna on the newly arrived American is altogether favorable. The pavement is much more uniformly good than he sees at home. There is less asphalt than we have, but the granite blocks, which are almost universal, are very regular and are very closely laid. They are perfect cubes of about eight-inch size; their surfaces are flat, and their edges are sharp. As they are stacked in the depot, a dozen rows high and in piles some fifty feet long, they lie almost as close and true to line as so many pressed bricks. In the streets they are laid, on a true foundation of concrete, in diagonal rows, the lines of their opposite corners running straight across from curb to curb. The surface is as nearly flat as the need for drainage will allow—much flatter than with us. I should say that on

a roadway twenty-five feet wide, the middle is not more than two inches higher than the edge, and there is no perceptible deviation from a true surface either crosswise or lengthwise of the street. The joints between the blocks do not average more than a quarter of an inch. The material is hard, but it seems not to become slippery after years of use. The asphalt pavement is equally good, and both are on the average decidedly better than with us. The curb-stones are heavier and lower, and the sidewalks are very carefully laid—often with the same blocks as the streets.

The tracks of the street railroads are grooved rails, somewhat like those on Broadway, but they are heavier, and the two sides of the rail are equally high and equally broad. The groove in which the flange of the wheel runs is narrower than the narrowest carriage-wheel, so that in driving, the wheel passes obliquely to and fro over the track without interference from it or from the pavement beside it. Contrasted with our "centre-bearing rail," with a deep wide groove between it and the stone on each side of it, angering the driver, wrenching the vehicle and shortening its life, this Viennese device is most attractive. From the street cleaner's point of view, the small channel to be cleaned by the railway-man's scraper is a vast gain over the two deep wide ruts that no broom can clean properly. Doubtless the cost of introducing this improved rail in New York would be covered in a very short time by the saving of wear and tear of vehicles and harness, and by the greater durability of the adjacent pavement, to say nothing of the comfort and cleanliness which it is one of the first duties of city government to secure. As an incident of the changing of motive-power and other work, a number of tracks here are now receiving the new rail.

The sidewalks are uniformly and always clean; they are swept twice a day by the householders, and, except in the colder months, they are sprinkled twice a day by some domestic device, ranging from a large bottle, or a pail of water and a whisk, to a watering-can. I asked the head of the street cleaning service if he had difficulty in securing the proper performance of this work. He said that he gave it no attention whatever; that all the people do

it as a matter of course, just as they attend to the floors of their houses, especially to those which may be seen by others. I frequently saw persons turn aside to spit in the street; I never saw one spit on the sidewalk. I mention these deviations from the cherished practice of my native land not because I am "un-American," but because it was my purpose to learn what I could, and to report what I learned.

In the matter of street sweeping we are at no such disadvantage. Our best paved streets, though not so well paved as these, are better cleaned; and our worst streets, with a pavement that would not be tolerated anywhere in Europe, are cleaner than the average of all except the best, in Vienna. The finer thoroughfares in the central part of the city are swept by machine between eleven and four in the night—so much as can be done by ten two-horse machines with their attendant sprinkling-carts. I drove out at four o'clock, but was already too late to overtake them at their work. In some places I found the sweepers taking up the "stroke" of the machines. It was trifling in amount, because these streets are constantly swept in the daytime. The machines give a fair start in the morning; but this is a very busy town, and when the men came on for their work at six, there was already much for them to do.

The sweeping force cannot compare with our own. Many of the men are old, few of them seem to be industrious, and they dress like the New York sweepers of days long past. They use long-handled birch brooms, which they swing over a wide swath, and when the street is dry they raise a cloud of dust. Some of them used (and most of them seemed to have) cans with very long spouts terminating in rose-sprinklers. The can is held against the breast, and the body is swayed from side to side, throwing the water over a considerable width. It seemed a good plan. Aside from the broom and can, each sweeper has a shovel, an odd-shaped dust-pan, and a medieval two-wheeled hand-cart, weighing as much as a buggy.

The dust-pan has a sheet-iron bottom about eighteen inches square, and wooden sides and back about eight inches high (the

back higher than the sides). From the back there rises vertically a handle of narrow board, with a hole for the hand; the board reaches to about the height of the armpit. This is held with the left hand and arm, the iron bottom flat on the ground, and the long broom is worked with the right hand. When the pan is full it is carried to the side of the street and dumped in small piles. In due time the hand-cart is trundled to one pile after another, and is filled with the shovel. Then it is wheeled away to some convenient place where the traffic is not too active, and its contents are shovelled out and added to a fast-growing heap, which is afterwards shovelled into the great wagons that haul it away to the point of final disposal.

Vienna is divided into nine wards. Only the first (Bezirk I.), the fine central part, is cleaned entirely by the city's own force. The others are largely cared for by contractors. There is a good deal of macadam in all the wards, even in the central one. The areas are recorded by square metres, which is necessary because some streets are 200 feet wide, and some not over 20 feet, with roadways in proportion. The whole roadway area is equal to about 550 miles of our streets. The paved street area of the first ward equals only about 25 miles of ours. This is all as well cleaned as the Bowery and Grand street, much of it as well as Fifth avenue and Broadway.

The cost of cleaning this 25 miles, including the removal of sweepings and house wastes, sprinkling twice a day in the warmer months, and removing all the snow in winter, is about 400,000 gulden. At the present rate of exchange the gulden is worth 41½ cents. In wages it is worth, as compared with street cleaners' wages in New York, about $2.94. That is to say, the pay of a sweeper in Vienna is one gulden per day, and he works ten hours. Our men get $2.30, and they work not much more than eight hours. All expenses are in about the same proportion, and this is to be remembered when the cost of our work is compared with that of Europe. A mile of street in the heart of Vienna (calculated to our width) costs, sprinkling and snow included, about 16,000 gulden a year. A mile of average street in New

York costs, without sprinkling and snow, $7,190. As indicated above, our men work more faithfully, and our streets, on the average, are cleaner.* The outlying eight wards in Vienna are mostly very imperfectly cleaned. The outlay for the whole city is only about 1,500,000 gulden.

The average cost of snow removal *in the first ward* is from 80,000 to 100,000 gulden. After heavy storms as many as 12,000 extra men are hired—mainly in the first ward—and thousands of teams are hired. A bargain is made with each to haul away the snow from a given area.

"SECTION 7.†

"The Contractor must be ready to furnish teams and drivers "whenever requisition is made upon him. * * *

"He agrees to send a man (after each snow-storm) to each of "the District Superintendents to receive their instructions. "Superintendents have the right to send written orders during "the night, and the Contractor must be in a position to begin "work three hours after the receipt of a requisition. If snow-"plows are used for the removal of slush, the Contractor must "be ready to start the work six hours, at the latest, after receipt "of the requisition." * * *

The work is well systematized as to all that is done by the department, save that the sweepers are not kept up to the mark as they might be. The chief overseer of each district gets only 1,500 gulden per year, while our district superintendent gets $1,800; but he is usually a man of good position, and he esteems it a great honor to have such important work intrusted to him, and he devotes himself to it.

The collection of house wastes goes on all day, but the collecting-wagons have notice given of their coming, by bell or otherwise, and the garbage, etc., in boxes and baskets of every sort,

* Items requiring the men to be polite to the public, well dressed, obedient to orders, sober, industrious and experienced, are found in all regulations concerning Vienna, Turin, Genoa, and, in fact, all foreign cities. And it may be said that in all respects the rights of the public are recognized as preeminent.

† From regulations concerning bids for contracts for furnishing horses, harnesses and drivers for the City's snow-plows.

are set out just in time for them. These wagons are very large and cumbersome, and they are covered. They collect sweepings and house wastes indiscriminately, and are hauled out about an hour's distance into the country, where their contents are turned over to the "scow-trimming" contractor of the locality. The unsaleable refuse is finally used for filling depressions left by the old course of the Danube. The contractor and his wife work at the "picking," like the men, women and children whom they employ. Their business is well managed, and little that can be turned to account is allowed to escape. An important item of their collection is fuel—bits of wood, cinders, coal, etc.; and this is made the subject of a very Yankee-like piece of cleverness. The workmen are allowed to carry home all of this material that they collect on Saturday. They seem not to consider that the sufficiency of their output in the same line on the other five days of the week is measured by the Saturday standard.

The removal of garbage is governed by the following regulations:

"SECTION 1.*

"Garbage, house and street sweepings are removed under "contract between the Common Council and a Contractor, the "contract expiring June 30th, 1895.

"SECTION 2.*

"Contracts may be entered into for special districts or the "whole territory.

"If, during the term of a contract, new buildings are con-"structed or markets opened, the Contractor is obliged to include "these in his regular service without therefor being entitled to "receive extra compensation.

"SECTION 3.*

* * * "Carts and horses shall be submitted to the Dis-"trict Superintendent for inspection and approval.

* Extracts from ordinances relative to the removal of garbage, house and street sweepings, etc., under contract approved by the Common Council under date of November 30, 1892; contract term January 1, 1893, to June 30, 1895.

"SECTION 4.*

"The Contractor agrees to furnish the necessary number of "laborers and drivers for the removal of garbage and sweepings "and to keep his personnel in decent clothes. The man who "receives the receptacles and dumps their contents into the carts "shall wear a strong linen garment (with a hood) over his ordi-"nary clothing, which garment he shall neither take off while at "work nor shall he be permitted to wear the same after his work "shall have been completed.

"The men have no right to refuse the removal of sweepings "or refuse which is tendered them, and they shall not demand "fees. In case of complaints, the Contractor must immediately "remedy the same.

"SECTION 5.*

"House sweepings and refuse shall be removed twice per week "—*i. e.*, on Wednesdays and Saturdays. If a holiday falls on "one of these days the work shall be done on the preceding day. "It is left to the discretion of the District Superintendents to "change these days. From April 1 to October 31 the work "shall begin at 5 A. M. and terminate at 6 P. M.; the working "hours from November 1 to March 31 are from 6 A. M. to 5 P. M. "Should the District Superintendent so decide, the Contractor "would be bound to limit the working time to the hours of "6 A. M. to 10 A. M., and 7 A. M. to 11 A. M. respectively.

"The Contractor has to send the carts at regularly fixed hours "and always on a regular route which shall have been decided "upon by the District Superintendent. The Contractor is held "to strict compliance with all orders given by the Superintend-"ents. The refuse and sweepings piled together by the City's "laborers on public market-places must be removed by the Con-"tractor whenever requested by the Superintendents so to do. "This is to be done after the market-hour is over and on Sundays "and holidays before 9 o'clock A. M.

* Extracts from ordinances relative to the removal of garbage, house and street sweepings, etc., under contract approved by the Common Council under date of November 30, 1892; contract term January 1, 1893, to June 30, 1895.

"SECTION 6.*

"The driver of a cart shall walk his horse and stop at every "house. He shall announce his arrival by ringing a bell.

"The dumping of the contents of receptacles must be done "carefully, so as to prevent the annoyance of pedestrians by "dust. The rear of the cart shall be opened only sufficiently to "permit of the passage of the receptacles. On certain specially "broad streets, which shall be designated by the Superintend-"ents, the carts are prohibited from occupying the middle of the "roadway, and must be kept near the sidewalks.

"SECTION 7.*

"The material gathered becomes the property of the Con-"tractor. He is at liberty to provide a suitable dumping ground "or to use the City's public dumping ground, in which latter "case he is bound to share the expense of keeping the roadways "within this dumping place in good condition. * * *

"SECTION 8.*

"The Contractor is paid in monthly payments on vouchers "which shall have been approved by the District Superintend-"ents."

It is hardly necessary to say that no fair comparison can be made between the street cleaning work of this city and that of New York, even if it would be proper for me to make it. The conditions are all very different. Some of our methods could be adopted with advantage in Vienna, and some of their apparatus would be worth trying in New York. For example, their sweeping-machines are of a much better pattern than ours, and they have a snow-plow that is most useful. Though this latter costs about 900 gulden, the street railways use 200 of them, and the city has nearly the same number for its own work.

* Extracts from ordinances relative to the removal of garbage, house and street sweepings, etc., under contract approved by the Common Council under date of November 30, 1892; contract term January 1, 1893, to June 30, 1895.

There are street-sprinkling wagons of various sorts. One has about eight feet of hose leading from its tap, and a boy, walking at a safe distance behind it, jerks a connecting-rope in such a way as to swing the end of the hose from side to side, throwing a good spray over a width of four yards or more. This seems crude, but it is effective. Another wagon which finds much favor in the department is a very complete machine. Its reservoir of iron is hermetically sealed, and it has an air-pump, worked by the revolution of a hind wheel by means of a sprocket and chain (like a bicycle). The pressure may be regulated anywhere from one ounce to thirty pounds per square inch, and the spray may be delivered to the rear or to either side at will, or to the full half-circle. Everything is under the easy control of the driver. The work is effective for a width of twenty-five feet or more, or less, according to the pressure given. It is a great advantage of this watering-wagon that it sprinkles the streets without deluging them.

Street sprinkling is governed by the following regulations:

"SECTION 1.*

"The sprinkling service of all the City's districts (District 1 "excepted) is performed under contract with one or several Con- "tractors.

"SECTION 2.*

"Bids for contracts may relate to a single or to several districts "or the whole territory of the city. Should it become necessary "to interrupt the sprinkling of certain portions of the territory "included in the contract during the term of said contract, the "Contractor agrees to submit to the substitution of other streets, "as the District Superintendent may deem fit to designate. The "Contractor is bound also to conform with the orders of the "District Superintendent if he be requested to sprinkle certain "streets, public places or parks oftener than provided for in the

* Extract from ordinances relative to the contract for the sprinkling of streets within the city's boundaries, in Vienna, 1882.

"contract, and is not entitled to extra compensation if, during "the same period, other streets of approximately the same area "which it was his duty to sprinkle under his contract are "excluded from the service.

"SECTION 3.*

"The City furnishes the necessary water out of certain "hydrants without receiving any payment therefor. At the "beginning of the contract the City turns over the wrenches and "hose which appertain to said hydrants to the Contractor, and he "is responsible for them and must return the same in good con-"dition to the City at the expiration of his contract, ordinary "wear and tear excepted. The Contractor is not allowed to use "other hydrants than those specially assigned to him and he "cannot use the water for any other purposes than those men-"tioned in the contract. If, for any reason, some or all of the "hydrants thus assigned to him should have to be abandoned "temporarily, the City will designate the public fountains, etc., "which shall take the place of the hydrants, but the Contractor "shall make no demand for extra pay in case he should be sub-"jected to an increase of work by reason of the change in the "water supply.

"SECTION 4.*

"The period during which sprinkling is done begins on the "1st of April and ends on October 15. It is, however, left to the "decision of the District Superintendents to order the sprink-"ling service to begin sooner or later or to terminate sooner or "later. The Contractor agrees to accept an appropriate increase "or decrease of his contract price in accordance with an increase "or diminution of the work performed. All streets, public "places and roads included within the provisions of the contract "shall be sprinkled twice every day, *i. e.*, between 6 A. M. and "10 A. M., and between 2 P. M. and 6 P. M., unless the District

* Extract from ordinances relative to the contract for the sprinkling of streets within the city's boundaries, in Vienna, 1882.

"Superintendents should decide upon other hours, in which case "the Contractor is bound to carry out their decision. * * *

"SECTIONS 5, 6 AND 7.*

* * * "The wagons and horses to be used must be "submitted to the approval of the District Superintendents. "The horses must be strong and kept in good condition. The "Contractor must furnish two men with each cart and one man "for each hydrant. The cart-drivers are not permitted to fill "the sprinkling cart themselves. The men employed for this "purpose are instructed by the Department of Sewers and work "under the supervision of its employees. The Contractor has "to observe that his men are decently attired. He must dis-"charge any of the men on demand of the City's author-"ities." * * *

BUDAPEST.

Budapest, although it is now celebrating its thousandth anniversary, is practically a new city. To those who are fond of international comparisons, it is "the Chicago of Europe." The comparison is not altogether apt, for it is very well and handsomely built to its outer edges, and its public buildings and public places are regal in their aspect, while it has very little of the wonderful industrial and business activity of Chicago. Its principal streets are wide and long, and they have stretched out over the level plain with marvellous rapidity. Both towns have grown too fast, and are now feeling the effect in the form of financial lassitude. Here the resemblance stops.

From the point of view of the street cleaner, no comparison is possible, for the Hungarian capital is very clean. It is—save in some of its older streets—unusually well paved, where it is paved, and perfectly macadamized where it is not paved. Andrassystrasse, the finest and longest street, is paved with wood, after the

* Extract from ordinances relative to the contract for the sprinkling of streets within the city's boundaries, in Vienna, 1882.

best London and Paris model—than which nothing in the world is better, from the street cleaning and all other points of view.

In the matter of the sweeping of streets and sidewalks and of the collection of household wastes, the methods here are substantially the same as in Vienna, save that the sweepers are active young men and are much more industrious. Other differences are only in details of little importance, except with regard to the cab-stands, which are many and are actively used. These are generally a little lower than the street, are graded to a sewer inlet, and are asphalted. They are swept and thoroughly flushed and scrubbed several times a day, so that the usual odor and untidiness of such places are entirely obviated.

The area of paved streets is equal to about one hundred and fifty miles of New York streets. The cost of snow-removal in the winter of 1895-6 was 160,000 gulden. Wages are one gulden per day. The entire cost for all cleaning, snow-removal, transportation of wastes, and street-sprinkling averages about 800,000 gulden per year.

In the matter of final disposition, Budapest is very instructive and interesting. Everything is hauled to a station some three miles away. Here the wagons, night-soil vans, etc., are dumped into cars standing in a tunnel under the dumping-platforms. The loaded trains run out about three miles farther, to Kleinpest, a point remote from all population, save for the two hundred and fifty men, women and children working about the disposal plant. They are a curious community. The works have been in operation for some thirty years, and most of those now employed were born in the "Kehrichtring" (Rubbish Boulevard), as they call their village. They are not an attractive community, and the older members are said to spend most of their wages in drink. Save for the effects of this dissipation, there is little sickness, and it is evidently not in itself an unhealthy industry in which they are engaged.

The whole business of final disposition is in the hands of a contractor, who has controlled it for twenty years or more. He is a very wealthy man and a large landholder, whose interest lies

largely in the value of the manure for his farms. He owns the dump, the railroad and its equipment, and the separating machinery. He receives from the city 115,000 gulden per year, in addition to the material delivered to him.

After this year his contract will be extended to include the collection in the town and the hauling to the dump; and he is building a branch line to connect his works with the state railroads, to widen the market for his fertilizers. He has, up to this time, made no money profit, but he has had a good supply of manure for home use, and has accumulated enormous deposits which the new railroad connection will enable him to sell.

The separation-works were started nearly thirty years ago by Mr. Ignatius Fischer, who was then the contractor. He had more ingenuity and enterprise than capital, and he became the manager of the works under his successor. He is a man of quick intelligence, and has built up, little by little, with the aid of a competent mechanical engineer, and lately of a chemist, a very complete factory for the separation of the wastes and the manufacture of fertilizers, etc. The chemist was for some years with Edison in New York. He is now carrying on successful experiments in the direction of the development of ammonia and other marketable products from certain parts of the refuse. Nearly all of the handling and separation of the material is done by machinery, only the culling out of the saleable wastes requiring manual labor.

The apparatus is contained in a large four-story brick building, with ample steam-power—unsaleable rubbish being the fuel used. The railroad cars are unloaded into small tram wagons, which are hauled by an endless chain from a tunnel under the track up a steep slope to the top of the building, where they are dumped into the mouth of a coarse revolving screen, which holds back large sticks, boxes, old baskets, broken watermelons (this is the land of the best and cheapest watermelons in the world), and other large objects. What passes through the wide meshes of this screen runs into another with a very close mesh. This takes out the dust and the fine horse-manure as ground up by the

wheels and the sweepers in the streets, and sends it to the wagons running to the manure dumps. The next screen divides the remaining material, roughly, into two grades, for easier hand-picking.

The picking-tables, which are very long, are furnished with endless aprons of heavy hemp cloth about two feet wide. These move slowly between two rows of women and children, who select the various treasures to which they are assigned, each after its kind. The white-bottle boy lets the green bottles pass, and the big-bone woman pays no attention to the small bones; these meet their fate further on. One group of children devotes itself entirely to corks, another to nails, another to strings, and so on. As the cloth finally turns over the end of the table it drops all of its rejected material into a conveyer, which carries it to the manure-wagon. In the heap to which it is added there goes on a process of "bacteriolysis" that reduces it all to the condition of a fine compost, fit for the fields. Curiously, to us, no use is made of paper or rags, save as they are required for fuel. The wood-pulp industry and the German tariff on paper stock have robbed them of all commercial value. This, too, in the face of a minuteness of economy that is careful not to let a single old cork escape, although the only sale for the corks is to make fenders for the use of the boats on the Danube. Nothing that has the slightest selling value is allowed to escape, and what cannot be sold in its present form is turned over to the productive industry of the microbes of the compost heaps.

It seemed to me that these very complete works, developed through years of patient study of the refuse of the saving population of Budapest, presented food for much thought to one whose official functions compel him to dump outside of Sandy Hook two and a half million cubic yards of the wastes of the wasteful city of New York, where rags and paper sell for a good price. Our conditions are very different from those of Budapest, and different measures must be taken here, but if we can ever reach the minute economy of the works at Kleinpest, we ought, with our richer refuse and our higher prices, to derive an

income from our rubbish sufficient to pay nearly all the cost of running the Department of Street Cleaning. In support of this opinion it is to be said that the recovery and sale of paper, rags, bottles, metals, rubber, wood, coal, bones, grease, corks, strings, shoes, hats, and other things that are thrown away, to the value of half a cent a day for each member of the population, would amount to much more than the whole appropriation for street cleaning. We may never reach this figure, but the sum total thus to be saved will surely be very large, and the experience of Budapest is full of promise and instruction for us.

BERLIN.

For several reasons Berlin offers special attractions as a field for the study of street cleaning methods from the point of view of the work in New York. In the first place, it is the only large city in Europe in which the sweepers are uniformed—beyond a special cap or badge, serving for identification, but not modifying the variegated clothing of the common workman. In the next place, Mr. Albert Shaw, in his *Municipal Government in Continental Europe*, gives prominence to the cleanly condition of the streets, and he sets forth in detail and very clearly the excellent government of Berlin, while Miss Colbron's paper in the New York *Times* last spring indicated a very good management of the Department of Street Cleaning.

My investigation showed, almost at the outset, the correctness of the Berlin department's own statement, in its last annual report, that "comparisons with other great cities cannot convey a correct impression as to the relative cost of the work, because the conditions are so different."

This applies to methods and to results as well as to cost. For example, in New York we sweep every street at least once a day; we do not sprinkle the streets; we do not sweep the sidewalks; we remove all household refuse, and we are charged with the final disposition of street and household wastes of every kind. This

last item costs us about $475,000 per year. In Berlin, on the other hand, the department sweeps the streets on an average of only three times a week; it sprinkles the street; it sweeps all the sidewalks; it has nothing whatever to do with household wastes of any kind, neither ashes, garbage, nor refuse; it disposes only of the dirt swept up in the streets and from the sidewalks, and it pays a contractor for this removal only about $140,000.

"The first principle in sprinkling is that all streets that are "regularly swept be also regularly sprinkled. * * * The ex-"pression 'regularly' sprinkled means that streets must be "sprinkled twice a day and under certain circumstances three or "four times, as may be required.

"An exception is made with regard to asphalt pavement. As-"phalt ought really to be kept dry, since that is best for carriages "and traffic. This cannot be done, however, on account of the "fact that asphalt can absolutely not be cleaned without a liberal "water supply, since horse manure when it gets dry does stick to "asphalt and cannot be removed during dry weather unless it be "previously soaked and scraped off. An ordinary amount of "sprinkling would therefore not be sufficient on asphalted streets. "They must be flushed. After this has been done squeegees are "used to scrape off the remaining dirt and at the same time dry "off the asphalt; otherwise the same would be slippery.

"Street-sprinkling, therefore, cannot be performed in an abso-"lutely fixed manner; it must be done subject to the require-"ments of the seasons, etc. * * *

"During the time included in our present report extensive "sprinkling was not necessary."*

With us practically no street dirt is allowed to be run into the sewers. In Berlin all that can be made liquid enough is so disposed of. We have to find our own points of disposal—thus far, at sea—while in Berlin this is the lookout of the contractor.

It is clear, therefore, that however much we may find that is of interest, we cannot make useful comparisons as to cost nor as to

* From annual report of street cleaning in the City of Berlin from April 1, 1894, to March 31, 1895.

processes. The rate of wages and the number of persons employed differ in a most important degree. Our force numbers about 2,700, of all grades, and we pay our sweepers and drivers an average of about $680 per year. In Berlin the force numbers only about 900, men and boys, and their average pay is not more than about $260 per year. Our annual outlay is about $3,000,000; that of Berlin is about $760,000. The two cities are of very nearly the same population.

Therefore, setting comparison aside, let us see just what the work of the department is in Berlin, and how it is done.

The more frequented streets are swept every day, others three times a week, others twice a week, and others again only once a week. Those that are not swept daily are looked to pretty constantly, and any excessive fouling is removed by ambulant gangs employed for this purpose. The sidewalks are swept early in the morning. Very much of the street sweeping is done by machinery, by contractors, and this is almost exclusively night-work, beginning at eleven o'clock and ending before six in the morning. The "stroke" of the machine is swept into heaps, shovelled into wheelbarrows, and dumped at convenient points, from which it is taken by the contractor's wagons. I was out on one very rainy night and found a good deal of this dirt being run into the sewer inlets. In these much of the sand is held back by a trap, while much sand and most of the mud enters the sewers, from which it is necessary from time to time to remove deposits by flushing or by mechanical means.

As in all European cities, sand is used very freely to prevent the slipping of horses on the pavements, especially on asphalt and wood. The sanding and the removal of the ground-up sand add much to the work of the department.

The asphalt pavement is mainly very good. The same can hardly be said for the wood pavement. And this is evidently the universal opinion of the cab-drivers. I had no opportunity to inquire into the reason for this defect, which does not exist in London and Paris, but I was especially struck with the fact that a wide expanse of wood pavement on Unter den Linden, near the

museum, was a series of small pools during rain, and that driving over this in any weather was very jolty business as compared with the asphalt in its neighborhood. Such irregularity of surface is a great drawback to successful machine-sweeping, and adds to the labor of hand-sweeping. Without noticeable exception, however, the pavement of this city is far, very far, from being so bad as that of most in New York. It is only our asphalt streets that are as good as these. On the other hand, there are in Berlin many macadamized streets which get only a superficial cleaning.

The following abstract is from the annual report of the City of Berlin for 1894 and 1895:

"It is obvious that good paving is of special importance with "reference to the cleaning of streets.

"On April 1st the so-called definitely good paving in our city "amounted to about 56%; asphalt pavings to about 22%, and "adding to these about 1½% of still remaining wood-pavings, it "will be seen that the city actually has 79½% of first class "pavings.

"In proportion as new pavements were laid the old defective "ones decreased, so that actually it can be stated that the latter "only continues to exist in little-used side streets, although, of "course, some time will pass before bad pavements will be en-"tirely done away with.

* * * * * *

"Special attention must be called to the cleaning and general "treatment of asphalt and wooden pavement. Both kinds of "pavings require cleaning from horse manure as often as pos-"sible, as it makes the road slippery, and damp places must be "sprinkled with sand. Subject to temperature and season, in all "cases, as often as can be managed, asphalt pavement ought to be "flushed, the manure soaked and then scraped off. After asphalt "has been wetted, as the probabilities are that it will not dry "rapidly (especially during spring and autumn), a little sand "ought to be put on. The same precaution is necessary during "rainy weather, as rain makes the asphalt slippery and unsafe for "horse-travel. The great extension reached by this kind of pave-

"ment has, however, already accustomed horses to walk on it, "so that they now fall but rarely. The advantages of asphalt "outweigh its inconveniences, and drivers and the public at large "get to prefer it more every year; the constantly increasing area "covered with asphalt is a proof of the correctness of our judg-"ment.

"Although wooden pavements require almost the same treat-"ment, the conditions and results are vastly different.

"The wooden surface is always more or less rough and uneven. "Dirt gets into these rugged parts and sticks fast; it is difficult "to even partly remove same. If the weather is dry much dust "is raised, while rain or sprinkling produce a great amount of "mud. These evils are inevitable and increase as the surface gets "more worn out and rugged; this state of affairs causes no small "trouble to the administration.

"We estimate also that driving is not nearly as safe on wooden "paving as on asphalt. During autumn and winter, in which "seasons wood dries very slowly, this pavement becomes slippery "to a degree of danger which can only be overcome by constant "and careful sand sprinkling. In addition to this, it is a fact that "wooden pavements are not sufficiently resistant and wear out too "quickly. For these reasons the wooden pavement is not greatly "liked, and it has not been laid during the past few years, except "in rare cases."

The question of the pay and the general treatment of the men is well worth our consideration. As we have seen, the rate of wages is very low. A gang-leader gets only 93 cents per day; a workman of the first class, only 81 cents; a workman of the second class, only 68 cents; and a boy, only 40 cents. These are more than the usual rate of wages, not only in Berlin, but in the country generally. From the standard of comfortable support, these amounts are obviously sufficient. The employees are strong, well fed, and in good condition, and the service is eagerly sought after; for, aside from the pay, the attending conditions are very favorable. In the first place, the city furnishes uniforms and tools, and it takes good care of its working people. The boys,

who are used mainly for cleaning the streets of horse-droppings and litter during the daytime, are taken on at the age of sixteen or seventeen. When they reach the age for military service they go into the army, and they have a preference for re-employment after their discharge. The second class men, who number only about seventy in all, are raised to the first class within a single year, and sometimes earlier, when especial fitness for the work is shown. After four years of satisfactory service the men are assured their positions for life, with the pensions and other benefits provided for. In other words, employment in the street cleaning service opens a life career to those who properly fulfill the requirements of their positions.

The work is exacting rather than hard. The regular men who follow the sweeping-machines work from midnight until eight in the morning, but they have a half-hour for breakfast, so that their actual work is only for seven and a half hours. The day men work from seven in the morning till seven in the evening in summer, and from eight till eight in the winter; but they have three hours for breakfast, dinner and supper, making the time of actual working nine hours per day. The force is changed about so that each has his fair share of day and night work. On Sundays and holidays the day men work only from six to nine in the morning, and they receive full pay for these days.

At the same time they are considered to be on duty every day at all hours, so that in the case of floods, heavy storms, snow, etc., they may be called on at any time for any amount of extra work. They are legally entitled to no extra pay for this, but the department has a small fund, furnished by the City Council, from which it may, and does, in its discretion, give a gratuity to those who have done especially well, or who may have shown special efficiency or fidelity in their work. This is accepted gratefully as a bonus, not received as a right. Taking the year through, day and night—Sundays, holidays, and all—and counting emergencies, the work averages eight hours per day.

One of the best features of the system is the manner in which illness and disability are treated. If a man is disqualified by

sickness, he is paid his full wages for three days. After that his pay ceases, but he gets the benefit of the sick-fund. If he is permanently disabled, supposing him to be a "life-member" of the force, the City Council awards him, in addition to the benefits to which he is entitled from the "sick-fund," etc., from $100 to $150 per year for the rest of his life. If he is able to do light work, light work he must do; but if he has been for four years a faithful member of the street cleaning force, he is sure of support till he dies. It is to be remembered that in Berlin soul and body can be comfortably kept together for even as little as one hundred dollars per year.

The gratuity from the Council comes from a fund of $1,000, which has been maintained since before the establishment of the "sick-fund," for use in the relief of special cases. From this source a disabled man may receive an amount equal to one-half his regular wages; and it sometimes happens that with this and the "sick-fund"—especially when a man is entitled to draw from two such funds—an idle man gets more than a working-man's pay. Such instances are very exceptional. As a rule, men who have been in receipt of benefits are very glad to get back to work again.

The "sick-fund" was established in 1892, but in this short time it has proved to be a great benefit, and the results have been most satisfactory. In 1894, out of a membership of 900, 318 received more or less help from the fund. The receipts of the fund were $8,462, and the payments for disability were $4,975. At the end of 1894 the invested fund amounted to $7,281. The prosperity was such that the committee was directed at the general meeting to increase the benefit from half pay for thirteen weeks' sickness to two-thirds pay for twenty-six weeks; and the death payment was raised from twenty days' pay to forty days' pay. Unmarried men in hospitals receive one-tenth of the amount of their wages for pocket-money. The flourishing condition of the fund makes these liberal disbursements safe. In addition to this fund there is a voluntary funeral fund, which gives aid to the families of deceased members.

In addition to all this, men who have served for twenty-five years get special extra compensation. In short, everything possible is done to make each individual man feel that he is not so much an employee of the department as one of its members, and that for the rest of his life he is sure of care, protection and support.

The uniform is modest and neat rather than conspicuous, and is thus less useful in calling public attention to the care the streets are receiving, and in enlisting public aid in the avoidance of littering. Perhaps it is better suited to the temper of the people of Berlin; but it cannot be doubted that in New York the fact the the sweepers stare the public in the face in every street has had much effect in securing popular approbation and assistance. The belted blouse of the Berlin uniform is originally black, but the weather soon gives it a not unpleasant greenish hue. The cap is flat and not large, and the trousers, at this season at least, are of unbleached duck—both long for good weather, and short, with long boots, for rainy days. Some of the men and many of the boys have a black haversack strapped over the shoulder, in which are carried a water-proof cape, a hunk of black bread, etc.

As already indicated, all manner of household wastes are removed by private contractors, of whom there are some two hundred, large and small. They take these wastes from the interior of the house, and our unsightly "receptacles" and ash-barrels are never seen on the sidewalk. There is no systematic method of disposal. Those who remove house wastes, as well as those who haul away the street sweepings, must provide their own dumping places. Much is sold for manure, some is used for filling low lands, and some is deposited in useless heaps. The city is growing so rapidly that its refuse must be carried further and further afield, with an attendant increase of cost.

* * * "A considerable portion of the street sweepings is "being utilized for fertilizing purposes and is transported in "scows. It sometimes, therefore, is a fact that the contractor "can realize some small profit from a sale of this matter, but as "a rule he does not derive much benefit therefrom; the freight

"costs are generally heavy and the contractor is therefore gener-
"ally satisfied if he can simply find a buyer for the horse-manure"
(See report of City of Berlin, 1894 and 1895).

As a relief from this condition, very careful experiments have been carried on for a year or more in the direction of destruction by fire, but they have been abandoned because of the high cost of cremation when applied to Berlin refuse. While this process is reasonably economical in Hamburg, where English coal is largely used for fuel, leaving a certain amount of combustible cinder in the ash, which helps the burning, it is found that the "brown coal" and "briquettes" used in Berlin make much more ash which has no remnant of fuel left in it. What is to be done in the matter is not yet determined.

Cremation Experiments.*

"The problem of destroying the garbage by process of crema-
"tion has been considered for a number of years because it was
"usually assumed that if these matters could be burned all san-
"itary danger contained in them would be avoided. It was also
"thought that if the cremation could be obtained in special cre-
"matories which would not require a special degree of heat, it
"would be the cheapest method of final disposition.

"The opinions on this subject differ greatly, but certain re-
"sults reported to have been obtained in some towns in England,
"induced the Common Council to take the question into serious
"consideration.

"By resolution, under date of June 16, 1893, a sum of about
"$25,000 was voted for the purpose of experimenting on the
"cremation of garbage. The enterprise is in the charge of a Com-
"mittee who have rendered a preliminary report and propose to
"render a final accounting some time in autumn of the present
"year."

I was not in the city long enough to form a correct opinion as to its cleanliness, and it rained much of the time, the rain helping

* Experiments made according to English methods (See report of City of Berlin for 1894 and 1895).

the work in some ways and hindering it in others. I got the impression that it is not cleaner, nor, save as to ash-barrels, more tidy, than New York. Possibly longer observation in better weather would have given another impression.

The following clauses, taken from the general report of 1895, regarding snow removal, may not be out of place at this point:

"The administrative year 1894–1895, is noticeably different "from the term immediately preceding, and indeed from all pre-"ceding terms, by reason of the considerable expenses incurred in "cleaning the streets. This, however, cannot be ascribed to a "series of extraordinary conditions. Spring, summer, autumn, "and the early part of winter were all perfectly normal and simi-"lar in every way to the corresponding seasons of preceding "years; it was not until the second half of winter that the equi-"librium was disturbed to an abnormal degree.

"The climatic conditions of the winter season necessarily in-"fluence considerably the cost of street cleaning, be this, as was "the case last year, in reducing, or, as during the present term, "in increasing the same.

"The following schedule of the expenses incurred in winter "during past years is conclusive in this respect: These figures "show plainly that the winter expenses do not only influence the "otherwise well-balanced Street Cleaning budget, but that, in "fact, they are apt to become the principal feature in said budget, "as was again the case during the last term.

"The cost of the removal of snow and ice was:

$170,500.00	for	the	term	1879	$113,719.75	for	the	term	1887–88
20,635.20	"	"	"	1880	94,974.00	"	"	"	1888–89
43,601.50	"	"	"	1881	14,529.50	"	"	"	1889–90
26,342.50	"	"	"	1882–83	91,900.00	"	"	"	1890–91
6,262.50	"	"	"	1883–84	37,013.00	"	"	"	1891–92
29,560.50	"	"	"	1884–85	139,334.00	"	"	"	1892–93
73,021.50	"	"	"	1885–86	2,651.25	"	"	"	1893–94
53,291.00	"	"	"	1886–87	221,391.75	"	"	"	1894–95

"The average yearly expenditure during sixteen years, which "last year amounted to about $61,000, has increased to $71,141, "by reason of the unusually large expenditure of this last winter.

"The regular appropriation voted for snow and ice removal "was $41,000, the same amount as last year.

"The expenses incurred in the payment of wages to extra men, "hired for the removal of ice and snow, cannot, with accuracy, "be estimated in advance; they stand in close relationship to the "ice and snow removal, and, like these, increase or decrease in "proportion as the conditions of the winter may chance to "require more or less work to be performed.

"The wages paid to extra men amounted to:

$57,132.75	in	1879	$41,216.75	in	1887–88
12,846.50	in	1880	21,555.75	in	1888–89
16,467.00	in	1881	3,908.75	in	1889–90
8,458.00	in	1882–83	24,089.25	in	1890–91
2,056.25	in	1883–84	17,033.50	in	1891–92
9,608.75	in	1884–85	40,638.75	in	1892–93
24,437.50	in	1885–86	897.75	in	1893–94
16,636.00	in	1886–87	56,033.50	in	1894–95

"The yearly average of our expenditure in wages to extra men "for a period of 16 years was about $20,750 at the end of the "preceding year; the requirements of the present term increased "said average to the sum of $23,000. The voted appropriation "was $20,000.

"Comparing the above closely related figures we find that the "regular appropriation was either insufficient or too large in pro-"portion to the conditions and requirements of the different "years.

"DEFICITS RESULTED IN:

1879	to	the	amount	of	$152,182.85
1885–86	"	"	"	"	53,719.00
1886–87	"	"	"	"	21,157.00
1887–88	"	"	"	"	93,616.50
1888–89	"	"	"	"	49,523.00
1890–91	"	"	"	"	43,989.25
1892–93	"	"	"	"	117,970.25
1894–95	"	"	"	"	205,425.25

"BALANCES LEFT OVER.

1880	a	sum	of	$30,272.77	1884–85	a	sum	of	$4,580.50
1881	"	"	"	3,806.50	1889–90	"	"	"	53,561.50
1882–83	"	"	"	26,449.50	1891–92	"	"	"	17,952.75
1883–84	"	"	"	47,824.25	1893–94	"	"	"	63,251.00

"All these figures are of statistical interest, for, if we limit our-
"selves to the total expenses of the last twenty years, apart from
"the question of the expenditures incurred through winter, it
"will be found that street cleaning is only little more expensive
"to-day than it was in the year 1875, although since then the
"City has doubled in size."

PARIS.

It was with especial interest that I made my first examination of the streets of Paris, for I remembered them as being in excellent condition in 1889 (Exposition year).

After a close and careful examination I should say that they are quite as well swept as our streets, and that there is nowhere to be found the defective pavement of which we have so much. In the matter of litter, however, I think that New York is much better cared for. Except in the more frequented show streets, and to a certain extent even there, there is more paper scattered, and in many parts of the town much less attention seems to be paid to its collection and removal. On the whole, I think we lose nothing in the comparison. New York is as clean and at least as tidy as Paris. The methods of work in the French capital are in many respects different from what was found in other cities, and very different from the methods here.

In 1859 the cleaning of the streets was transferred from the Préfecture de Police to the Préfecture de la Seine, and it was then placed in the hands of the Engineering Department. The cost at that time could not be learned; but the cost in 1872 was 3,808,000 francs; in 1877 it was 4,618,000; in 1889 it was 6,530,000. It is now about 8,000,000 francs. Formerly it was the duty of all property-owners to clean one-half of the street, if this did not exceed six metres (20 feet). This work is now done by the city, and is paid for by a special tax on the property, which, for this purpose, is divided into three classes, that occupied (1) by buildings, (2) by walls or open grounds, (3) by vacant lots. In no case is the charge more than the actual cost to the

city. In some cases it is materially less. Property-holders must still remove snow and ice from the sidewalks, according to specific regulations.

The total surface swept (1889) was 15,562,000 square metres. Of this, the property taxed paid for 8,721,000 metres, and the city for 6,840,000. The amount of the tax was 3,140,000 francs. The average cost per square metre was 36 centimes (7 cents) per annum.

The sweeping force is divided into 149 gangs. In the central part of the city each gang consists of a foreman, assistant foreman, and 20 to 25 men or women, most of whom work during the morning, at the necessary sweeping, and to assist in the loading of the wagons. In the afternoon only the regular route men are at work. They keep the streets in order, wash the gutters and urinals, care for markets, etc. Outside of the centre, the gangs consist of one foreman, four route men, and 15 to 20 sweepers, the last usually working only in the forenoon. Work begins at 4 A. M. all the year round. The half day ends at 11 A. M., and the full day at 4 P. M. The entire force consists of 3,200 regular hands, with extra men for emergencies. The pay is by the hour, the men receiving 32, 34 and 37 centimes, and the women, children and old men, 25, 27 and 30 centimes. The route men are paid by the month—120 to 125 francs for the leaders, and 105 francs for the ordinary men. Of this they are required to pay five francs per month into a savings fund, which is repaid to them when they quit the service. All men regularly employed are also obliged to join a mutual benefit society.

The workmen of the street cleaning service of Paris are not uniformed, and, except for their numbered badges, they are not to be distinguished from other working-men. The slouchy and often faded blue or black blouse so generally worn is neither distinctive nor attractive. It is comfortable, cheap and cheap-looking.

Sweeping-machines are used for auxiliary work on paved streets and for emergencies, as during a thaw, and when it is required that the streets should be cleaned rapidly for special occasions.

All street sprinkling is done by the city, and under the direction of the engineers having charge of the cleaning. Sprinkling costs just about twice as much per square metre for macadam, of which there is a great deal, as for pavement. The water-carts weigh when empty about 1,400 pounds, and when full about 4,000 pounds, with the driver. Where water is conveniently furnished they deliver at least two loads per hour. The sprinklers cover a width of about 16 feet, and one load suffices for 800 to 900 square metres; 370 water-carts are now used. These belong to the city, which hires horses—one to each cart—and drivers at 340 francs ($68) per month.

More recently, on the principal streets, much use is made of jointed pipes attached to hydrant cocks provided for the purpose. This apparatus is made of from four to six pieces of pipe, each two metres long, with flexible joints, and running on small, castor-like trucks. They reach to about seventy-five feet, and the cocks supplying them are about 150 feet apart. The work is very effective, and costs only half that of water-cart work.

On asphalt and wood much use is made of the squeegee (a rubber scraper). A man working this walks at least at the rate of two miles per hour and covers 1,200 square metres. If strong and skillful he may cover 2,000 metres. There is still a good deal of work done in a much more primitive and antiquated way. Water is set running in the gutters, and is dammed here and there by a bunch of untidy-looking old rags. The workman throws this water with a common scoop over the sidewalk and into the street. This does very well for washing sidewalks in conjunction with the squeegee, but its use is certainly not to be commended on the score either of tidiness or of economy. All pavements are sprinkled before sweeping if the weather is dry. If the streets are slimy from light rains the squeegee is used. Unless there is much mud or horse-manure, machines are not needed. When the machine is used in wet weather, or in dry, the stroke is gathered together with a common birch broom, such as is used in Budapest and almost universally in European towns. The sweeping-machines used cover 6,000 square metres per hour.

It is stated in the official report that what cannot be taken up is washed into the sewer, and that where there is much sand they save what they can of it for resanding the streets when slippery. To the ordinary observer it seems that they wash into the sewers all that can be got rid of in that way, and the accounts given of the amount of deposit regularly cleaned from the sewers would indicate that this method is carried to excess. It leads to the conclusion, which my earlier observation in other directions has indicated to be correct, that the sewers of Paris are many of them as dirty as the streets are clean.

In dry weather wood pavements are washed daily, asphalt every two days, and stone and macadam every three days. This washing is done between 4 and 8 A. M.

The order of work is as follows: From 4 to 6.30 A. M., sweeping and washing of sidewalks and streets, washing and disinfecting places soiled by urine, and cleaning public urinals; 6.30 to 8.30, assisting the wagons in taking up house wastes and general sweepings; 8.30 to 11, gathering droppings, washing gutters, sprinkling streets, cleaning and disinfecting urinals; 11 to 1, midday meal. This may be advanced to 10 o'clock or put off till 12 if the exigencies of the work require it. Sometimes only one hour is allowed for the meal. In very hot weather the sprinkling is continued through this noon rest, the men taking turns, but each being allowed one hour for his repast. From 1 to 4 the same work as from 8.30 to 11; from 4 to 7 this work is continued in case of necessity; from 7 to 9 P. M., during the five winter months, continuing the occasional sanding of asphalt and wood which has gone on during the day. This is supplemental work, and the men do it by turns. The work about the markets continues from 7 A. M. to 9 P. M., at intervals, and as it can be done without interfering with the operations of the market-men. It includes the disinfection of all places soiled, as by cleaning fish, etc.

The official report of public works says: "The streets are sanded as many times during the day as is necessary to prevent the surface from becoming slippery. This is one of the operations of which the performance should never be delayed."

The garbage and other household refuse, as well as the sweepings of the streets, are taken up by the wagons between 6 and 8.30 A. M. in summer and between 7 and 9 in winter. Garbage was formerly placed at the edge of the sidewalks. This led to a very untidy condition from the scattering of the material by rag-pickers and others, and accidents resulted from the falling of broken bottles, pottery, etc., into the streets. To avoid this, owners are now obliged to provide for their tenants, from 9 P. M. until morning, one or more receptacles for all household wastes. These are set out at least an hour before the time for collection, and are taken immediately after collection. They have to be kept in a sound and cleanly condition, and they can receive nothing but household wastes.

Every three years bids are received for the work of collection, the contractor becoming the owner of all that he collects. Formerly this resulted in a profit to the city—that is, the material was worth more than the cost of removal. Then for a time the value was about equal to the cost. At present the city pays for its removal over 2,000,000 francs per annum. One reason for this change of condition is that there is now a smaller number of subcontractors, such as the market-gardeners, who used to occupy lands now covered with buildings, and who aided the city contractors in their work, and paid something for what they collected; another is the greater distance to which it is necessary to cart all refuse, because of the growth of the city; and especially because the authorities of suburban districts have become more severe in their requirements as to the deposit of waste materials. These conditions have also led to an increased cost of the material as delivered to farmers, so that these now prefer to buy stable manure. For purposes of removal the city is divided into sections, for which special rates of payment are tabulated. Selected and well-known contractors bid for each section—so much more or less than the fixed tariff. They are required to take all refuse from houses, restaurants, barracks, etc., etc., to remove street sweepings, including fallen leaves, all market refuse, and such spoiled food supplies as are seized for bad condition. The con-

tractor himself chooses the route for the working of the different wagons in his section, but this is subject to the control of the engineer, with a view to the prevention of overloading, interference with traffic, and too early hours for the comfort of people who are not early astir. These routes cannot be changed without the approval of the authorities. In regulating them the contractor arranges for a certain amount of work to be done by farmers' wagons at convenient hours and places. The contractor's vehicles are generally large, with broad tires for country travel. They have a hoisting apparatus for loading, and are served by two men.

The coming of the wagon to remove household refuse is announced by the ringing of a specified bell. It is required that all wagons be kept painted and thoroughly disinfected, and the administration has control over the men as well as the vehicles. The city provides three men or women during the two hours of collection to assist in loading each wagon. If receptacles are roughly handled and injured, the employee is held responsible, and is obliged to pay for repairing or replacing them.

The contract for the removal of refuse includes an obligation to furnish teams for sweeping-machines and water-carts at a fixed tariff. In case of need, the contractor must help in the removal of snow and ice. The contractor must present himself daily, at a fixed hour, at the engineer's office for instructions, and he is obliged to keep his own office open from 8 A. M. to 4 P. M., and to maintain telephonic connection there.

A two-horse wagon service, including the collection of house wastes and sweepings—that is, including everything that is to be carted away, serves an average population of about 3,500. Each wagon costs the city, on an average, from ten to eleven francs per day.

No comparison can be made as to the cost of carting in Paris and New York. The French are less wasteful than we are, and household refuse consequently amounts to less; but, on the other hand, we have to remove everything, while a very large part of the street sweepings of Paris is run into the sewers.

There is one curious thing about the collection of the materials in Paris—that is, that the rag-pickers seem to be under the special protection of the government, and are allowed full swing at the receptacles as they stand on the sidewalks, and even on the wagons as they are being loaded. What we call "scow-trimming," for which the city of New York receives a large sum, is thus abandoned to individual enterprise, and is carried on at the source of supply rather than at the point of dumping.

Efforts thus far made in Paris to utilize garbage have resulted in loss. It was thought that the shells of mussels and oysters might be converted into a manure, but this scheme has been given up. and they are now dumped into abandoned quarries in the vicinity of the city.

The question of distant transportation of the city's wastes, by water or by rail, has been carefully investigated, and the outlook is not promising. Water transportation means a difficulty from droughts, which may interfere with it for weeks together, from floods, which are often serious, and from the freezing of the waterways. This method is therefore unavailable, because it is not reliable for the daily use which is absolutely necessary. Delivery by rail has thus far been found too expensive. In order to reach lands poor enough to make matters of this kind of value, it would be necessary to go so far as to make the lowest possible rate of freight prohibitory. The question has been mooted of establishing a model farm for the city, on which to demonstrate the value of the wastes.

Incineration has also been considered, but it was found that the original investment for buildings and machinery would amount to 6,000,000 francs, and that there would be the embarrassment that, while the material is collected in two hours in the morning, economical working would require the incineration to be continued uninterruptedly day and night. The whole question is still open, and it is an extremely knotty one. Everything points to a steady and large increase of the cost of final disposition, whatever method may be resorted to.

Neither in street cleaning, in the removal of household wastes,

nor in final disposition did I find any suggestions which would be of use in New York, save as to the value of the salable refuse.

Until and including the winter of 1879-80 the removal of snow and ice was carried on according to regulations promulgated by the Préfet de la Seine, which determined the obligations of property-owners and of the Administration. These are still in force, at least with regard to the duty of owners, who have to clear their sidewalks of snow, putting it into the street, or in banks on the walk itself; to break the ice in the gutters; to spread sand, ashes, or cinders on frozen surfaces; and finally, in certain cases—but only on the formal requisition of the Administration—to pile the snow of the street itself.

At the beginning of each winter printed notices are served on all owners, reminding them of their obligations. It is to be admitted, however, that their concurrence is secured only with difficulty; it is often necessary to call in the aid of the police, to bring many suits at law, and to enforce judgment in a great number of cases. This complicates the work of the Administration when all its energies are needed for the work on the streets. It is especially prohibited to deposit on the public thoroughfare any snow from roofs or from inner court-yards. There is published each year a list of places to which this snow may be carried.

Up to the date named the Administration provided for the clearing of the streets with the ordinary force of street cleaners, supplemented by numerous auxiliary workmen, by the fifty wagons which the omnibus company is required by the terms of its franchise to furnish, and by the teams which the city has the right to exact from the contractors who remove street sweepings and house wastes. As all these resources were insufficient, contracts were at the beginning of the season made with private persons to furnish a certain number of wagons by the day. The city had no apparatus useful for snow-work, other than its sweeping-machines. The use of salt had not yet been seriously tried.

This organization had nearly always sufficed, because in Paris snow seldom lasts more than a few days, and thaws rapidly. But

the experience of 1879-80 demonstrated that when much snow falls and the cold continues the usual methods are absolutely ineffective. As a consequence, new regulations were made, which have worked well. These were:

1. The organization of the entire force early in the season by defined areas, so that the foremen and the men should know just what they were to do at the beginning of a storm, and so that without waiting for further orders they should betake themselves immediately to their posts.

2. Fixing the order of operations for removing snow from the streets according to their importance.

3. The use of mechanical aids to hasten the removal, and the application of salt to hasten the melting of the snow.

4. Dumping the snow into the river and discharging it into sewers.

5. The extensive co-operation of private enterprise, by turning over to contractors a portion of the hand-work and of the carting.

In time of snow all of the *personel* of the street cleaning department is employed for its removal. Each gang has its appointed rendezvous, its sand, its salt, and its prescribed place of discharge.

The streets are divided into three general categories: (1) wide streets, where the snow is piled in two rows, leaving a central space of from fifteen to twenty-five feet wide—provisionally; it is to be widened if time permits, either by piling the snow upon the sidewalks or by putting it all in one row; (2) narrow and crowded streets, from which the snow must be entirely removed; and (3) streets where it is to be piled in a single row to remain until it melts.

The sweeping-machines are provided with special brooms—prepared in advance—which have steel wires mixed in with the ordinary piassava. These can be substituted very quickly for the common broom. This system has the great advantage that it allows the use of a machine which is known to all, and which is made ready for snow-work in a moment. An extra horse is re-

quired. A rude sort of snow-plow is used to make the first opening in the middle of the street.

The use of salt for melting the snow is carried to a considerable extent. Pure fine salt for this purpose is delivered at the railway stations at about six dollars per gross ton—the state and city taxes, which amount to thirty-two dollars, being remitted. It was first used on a large scale in 1880. It produces a dark-colored slush, with a temperature of about 10° Fahrenheit, which will not freeze unless the thermometer falls below this degree. When it does not interfere too much with traffic in the streets it is often left in place for several days, because it does not freeze, and is to a considerable extent a preventive of slipping. If it becomes too thick it is removed with scrapers or with sweeping-machines. "Another property that is much appreciated in the use of salt in Paris is that it is the more rapid the more active the traffic; on streets of great travel the snow of the salted surface is reduced to mud in two hours."

The salt is spread from wheelbarrows by the shovel, and does not need to be very uniform. It is estimated that to melt packed snow to a depth of from one inch and a half to two inches about five ounces of salt are required per square yard. If the snow (packed) is six or eight inches deep, a surface layer is first melted and removed, and the lower layer is salted in turn. So far as the very complete official report is concerned, no account is taken of the effect of the salt and snow mixture on the health of the people, which is here thought to be serious.

From those parts of the city which are conveniently near the snow is dumped into the Seine, either at the landings or through openings in the parapet walls, which are closed after the winter weather is over. For remoter districts the sewer openings are used as much as possible. Special snow openings are made in the larger sewers. As much water as possible is run into them, and men standing on the banquettes of the sewers push the snow forward. There are used for the snow service 512 ordinary manholes and 121 special snow openings.

As above stated, before 1880 the removal of snow was carried

on by the city alone, with its own forces, and thousands of workmen hired for the occasion. These it had to supply with tools, and it had to arrange for their regular and frequent payment. From lack of organization and discipline, these men did slow work, and they were all the more ready to take advantage of the situation because they were working for the public. It was therefore determined, following the custom in other European cities, to let out portions of the work to contractors. The city was divided into sections, well regulated as to convenience of carting and dumping, and a price was fixed per cubic metre for loading and removal. The administration, with its own men and machines, piles the snow in rows, and the contractors cart it away. This division of the work has been very satisfactory, especially with regard to rapidity of handling.

In addition to the above, certain work beyond their contract obligations is done by the omnibus and tramway companies, the city furnishing them sweeping-machines and scrapers, which they operate with their own teams.

The order of work is as follows: If snow falls in the daytime, the workmen—without waiting for it to stop—use their brooms, shovels and hand-scrapers to move it toward the sides of the streets, and from sidewalks in front of public property. House owners do the same for their walks, urged thereto by the authorities. In this way the effort is made immediately to clear a sufficient width for foot-passengers and for vehicles.

Efforts are especially concentrated on streets of the first importance. If at the time of beginning work the snow is as much as four inches deep, so that it cannot be moved by hand, then the sweeping-machines are used for the middle of the carriageway, and the snow is piled in rows by the men.

If the morning finds a depth of six or eight inches, the horse snow-plows (or side-scrapers) are used to open a width of from fifteen to twenty-five feet. These are followed by sweeping-machines. If these means do not suffice to bare the pavement, or when travel has packed the snow almost to the consistency of ice, it is heavily sanded, or is treated with salt to melt it. Freedom of

circulation being thus assured, the carting is begun, and the men are sent to clear the streets of the second class, and the snow is carted from them. If a thaw has not set in by this time, the streets of the third class are cleared in their turn.

As soon as a thaw begins, nearly all the contract carting is suspended, and the hydrants are opened; all the sweeping-machines are set at work, the slush is pushed toward the sewer inlets, "and in a short time the city has taken on its usual aspect."

The foregoing has been gleaned from the official reports of the "Directions of Works" of the Department of the Seine. It is written after nearly two weeks' struggle with the very heavy and badly drifted snow of December 15, and when the banks and piles of snow in three-quarters of the streets of New York are frozen solid. I have tried in vain to find a way in which the Paris prescription could have been made to give us relief.

LONDON.

London is the most unsatisfactory town imaginable as a place in which to study municipal administration. It is an agglomeration of separate communities.

The "County Council," which controls the whole area in a general way and for some specific purposes, has no voice in the direction of local affairs—beyond establishing standards below which local work must not fall.

The "City" of London occupies a central area covering only one square mile in the heart of the town. It has a night population of only about 37,000, but its day population is about eight times as large, while more than a million persons enter it on every week-day, and its street traffic is enormous, nearly a hundred thousand carriages entering it daily. Surrounding this on all sides are some forty independent parishes and districts, each with its own local Vestry or Board which directs all its local municipal affairs. The entire population of London is not far from five millions. There is no conspicuous dividing-line between the parishes; it is one great, solidly built town, with much uniformity of

appearance. It is only when one attempts to study its methods of public work that its composite character appears.

The methods followed in the City are, in a general way, a type of the whole—varied in almost every case in minor details, to learn all of which would result in little valuable addtition to common knowledge of street cleaning operations. I shall therefore confine my remarks mainly to what is done in the City. The work here is under the control of the "Commissioners of Sewers," whose engineer directs it. It includes street cleaning, street watering and washing, dusting, and removal of trade refuse. The force employed in 1896 consisted of 200 men, 180 boys, and 99 horses. There were used 79 vans, 16 water-wagons, with sweeping-machines, etc.

The arrangement of the work is as follows: All of the streets are swept daily, and in hot weather the main thoroughfares are squeegeed two or three times a day. The boys constituting "the street orderly" system work on all the main streets, and on some of the secondary ones. These active youngsters with their pans and brushes gather up the horse-droppings almost as they fall, emptying them into boxes fixed for the purpose at the edge of the sidewalk. They begin work at 7.30 A. M., and cease at 4.30 P. M. in winter, and at 5 P. M. in summer. On the more important streets they are kept at work three hours later, with excellent effect. The sweeping, by hand and with machines, is done entirely at night, after eight o'clock, when carriage traffic is nearly over. It continues until eight or nine in the morning. The streets are thus subjected to almost continuous hand-cleansing. In addition to this, when the weather is suitable and when it is useful to do so, they are washed with the hose and jet. This must always be done late at night, when nearly all carriage traffic has ceased.

The courts and alleys occupied by the poorer classes are cleaned every day by the manual forces, and from April to October they are washed two or three times a week. Some places are washed nearly every night throughout the year. About 25,000,000 gallons (United States) of water are used in this way.

The sidewalks are swept as occasion requires, and in hot weather they are cleaned with squeegees in the daytime. The collection of street sweepings, refuse and rubbish is very large, and is increasing, as is the cost of the work. In 1895 there were collected 30,812 loads of "street sweepings and slop," and 41,821 loads of house and trade refuse. The total removal of the year averages 233 loads per day for six days in the week. The engineer reports, with regard to trade refuse, that the habit of throwing it "into the dust-bins or other receptacles which should be used only for the ashes and ordinary house refuse appears to be much on the increase, and if this continues it must add largely to the cost of collection and the difficulty of getting rid of it when collected. It never was contemplated that the Commission should remove trade refuse without being adequately paid for it. To do so is to benefit particular traders at the expense of the citizens generally."

I ask for this quotation the very thoughtful attention of those "traders" in New York who feel themselves greatly aggrieved if the city ash-carts are even slow or irregular in removing the refuse of their business. The complainers are always "tax-payers," but they seem to disregard the rights of their fellow-citizens not to have their taxes saddled with the cost of other men's business processes.

The collections of all kinds are taken to a wharf on the south side of the Thames, where they are roughly sorted. What is valuable as manure is boated away to the country. All else, after the salable refuse is culled out, is shot into a "destructor," or cremator. This apparatus works day and night throughout the year, save for fifteen to twenty days, when it is stopped for repairs and cleaning. By the last report it destroyed in the year 23,117 loads (66 loads per day), leaving about 22½ per cent. of "ashes and clinkers more or less hard but valueless, and for the removal of which the Commission had to pay."

As is the case in so many other places, the question of final disposition is engaging the very serious attention of the authorities. In competition with concentrated fertilizers, street manure will

not bear distant transportation. As populations grow larger the increasing output adds to the difficulty, and there seems to be no escape from the requirement for the conversion of the material into an inoffensive product, by an inoffensive process, within a practicable distance of the point of production.

English opinion seems to have become fixed on cremation as the only adequate means of relief. At the same time it is not yet shown that cremation can be carried on without giving rise to nuisance, or at least to annoyance. Mr. Codrington, engineering inspector of the Local Government Board, in his report of 1888 as to twenty depots at which destructors had been erected, said: "Experience has shown that town refuse can be effectually burned in destructors and other furnaces without causing nuisance or offence at or about the works themselves," but he adds that complaints are received of "fine dust, and sometimes of charred paper proceeding from the chimney and falling at some little distance off," also of "an offensive smell, which, under certain conditions of the atmosphere, can be recognized at some distance on the leeward side of the chimney." If the chimney is built high enough to protect the immediate neighborhood, the annoyance is only carried to more distant points. The only thing that is clear about the whole matter is that municipalities will have to face a greatly increased outlay to protect the people against the results of the increased production of wastes which *must* be got rid of, and the cost of whose disposal advances in progressive ratio as the material to be dealt with grows greater.

In 1893 the medical officer and the engineer of the London County Council made a report on "dust-destructors"—"dust" being the English for all manner of household wastes. It was calculated that the yearly quantity collected amounts to "about 260 tons per 1,000 of the population. This would be about 1,300,000 tons for all London, or about 580 pounds for each person.*

The analysis of the material shows that it contains about 8 per cent. (or 104,000 tons) of what would be salable in New York, including paper, bottles, broken glass, tin cans, bones, rags, and

*The annual output in New York is not far from 1,250 pounds per person.

metals. No account is here made of wood, rubber shoes, leather shoes, hats, corks, strings, and some other trifles which are culled for sale by the "scow-trimmers" of New York.

At depots where cremation is not in use the method of handling is essentially the same as that described by Dr. Ballard in his report to the Medical Officer of the Local Government Board in 1878, which is briefly as follows:

The dust is dumped in the yard, where men and boys proceed to sort it, dragging the heap over with forks and rakes, collecting the bones, rags, etc. These are assorted into heaps and baskets. What is left is sifted to recover the bits of unburned coal. "The sifting is performed usually by women who sit on or close to the heaps, having one or more baskets by their side and a riddle in their hands. A shovelful from the heap is shaken in the riddle, and the ashes and dust having passed through, what remains on the riddle is examined, and bones, potatoes, bits of iron, etc., not removed by the first dragging process are picked out." The coal and coke are thrown on a separate heap. He says: "The sorting process is a degrading occupation. The women employed are often seen covered almost to the waist with refuse, and they continually inhale into their lungs air polluted by the surrounding accumulations of dust." Large heaps of material are almost always to be found in the contractors' yards. The removal by barge on which London is so dependent, is often interrupted by ice; the cargoes taint the air along the banks of the canals, and even when they reach their destination the question of rendering them innocuous is still unanswered. The natural solution is to shoot the stuff "in some sparsely inhabited district where public opinion is not strong enough effectually to resent its being deposited." This was written nearly twenty years ago, and the case has grown worse year by year.

The report of 1893 says: "The merit of the destructor is, however, in a sense, the main drawback to its popularity. The old system enjoys the great advantage that it quickly removes all cause of offence from general view, and few persons trouble themselves about the railway siding or the canal wharf or the shoot in

the country. The destructor, if it is to establish the claim that it deals with the refuse from the outset, must be situated near inhabited houses, and its chimney cannot fail to excite attention. Again, if the destructor causes nuisance, it will mainly affect those living at a considerable distance from it, and thus it excites opposition not of the inhabitants of houses in the poorer districts, which presumably exist in the neighborhood of the depot, but of the richer and much more critical population living half a mile or a mile away. It thus happens that while few complaints are received concerning crude forms of furnace with short chimney shafts such as are found in many dust-yards, and are used sometimes merely for burning paper, sometimes for dealing with vegetable refuse and ordinary house dust, considerable objection is made to much more perfect appliances furnished with lofty chimney shafts." The final conclusion is that every appliance should be of the best, and should be carefully worked and managed, "and under these conditions we think that the destruction of refuse by fire may be effected with success and without the production of nuisance."

The "City" is more important than any other single district of London; but it will not be without interest to refer briefly to the parish of Paddington, which has its disposal works on the basin of a canal connecting with the system by which the northern part of London is served, and whence barges are sent into the country.

Paddington wharf was suggested to me as a good point to visit, because it has not only the depot of the parish itself, but also the works of two contractors who clean the parishes of St. George (Hanover Square), St. James, and Marylebone. Simple machinery supplemented by hand-labor is used in the sorting. At the Paddington depot, which is well paved and drained and well kept, twenty-seven hands are employed, about half of the number being women. The work is carried on under cover. During the year ('95-6) 27,445 loads of dust were collected. The weekly range of loads was from 383 to 663. There were abstracted from this, 313½ (gross) tons of salable material, as follows: Coal, 9 tons; bones, 55 tons; rags, 144 tons; iron, 60 tons; various other metals, 4½ tons; white glass, 14 tons; colored glass, 36 tons.

The scrapings and sweepings from the streets are shot directly into the boats. "Slop" from wet streets goes first into a sort of cage, from which the dirty ooze runs into the canal, the more solid residue being boated away at a cost, including carting, boating and unloading, of 47 cents per ton.

At the contractors' wharves the same conditions prevail, but there was rather less neatness of management. No statistics were to be had concerning their operations. They are under control of the Vestry as to matters of nuisance.

The collection of dust in Paddington was, until recently, made only when a card with the letter D was exposed in the window, but the County Council now enforces a by-law requiring the sanitary authority of the parish to "cause to be removed not less frequently than once in every week the house refuse produced on the premises." The Medical Officer says that the system appears to work very satisfactorily, but at an increased cost.

The street-cleaning is carried out by gangs of sweepers, with horse-machines for scraping and sweeping. Main thoroughfares and important streets are swept daily, especially those paved with wood. Other streets of less traffic are swept two or three times a week. Slippery pavements are sanded, especially in frosty weather.

The general appearance of the streets in London as to cleanliness is much the same as that in New York so far as its more important thoroughfares are concerned. There is about the same amount of littering with paper and other refuse. The less important streets, which are swept only twice or thrice a week, are not so clean as ours, which are all swept at least once every day. But the pavement of such streets in London is *much* better.

BIRMINGHAM.

Birmingham is a great, fine, dull, humdrum town, with about one-quarter of the population of New York. So it must strike the visitor who comes to it fresh from the greater Continental

cities and from London. To the student of municipal administration it reveals a perfection of system, of executive completeness, and of economy which, if his standards have been formed in America, is simply amazing. It is well kept in all respects; yet the total appropriation for its Department of Public Works, including maintenance and all repairs of roadways, street cleaning, the disposal of wastes, the care of the sewers, flushing and street-sprinkling, all stable expenses, including renewal of plant and stock, public lighting, and providing and maintaining of urinals, etc., etc., for the year 1896-7, is, after crediting certain items of income, only $503,000. This result is possible only because of the perfect business management of all city affairs. Such economy will never be possible here so long as "politics" has anything whatever to do with our municipal administration. Naturally the lower rate of wages in England accounts for much of the saving, but the rate there is only about fifty per cent. less than it is here, and, at most, the payment of our wages would not raise the total outlay as above to more than $800,000.

The work in the streets, including repairs of pavement and macadam, sweeping and removal of sweepings, and all sprinklings, employs about 400 men (who work 54 hours per week) and about 160 horses. The gang-leaders are paid from $6 to $7 per week, drivers get from $5.50 to $6, and sweepers, $5.25. Selected men of this force do the road-repairing, being paid, in addition to their regular wages, a price by the piece for this work.

There are about 250 miles of street, of which about 40 miles are swept daily, 100 miles thrice a week, 100 miles twice a week, and 10 miles once a week.

There is one chief (Road-Surveyor) over the whole work, who is paid $2,500 per year, and six district foremen, who get nearly $600 per year.

Most of the more important streets are paved with wood. This becomes very slippery, and it is regularly sanded with a crushed "grit," having some fragments of broken quartz or flint as large as peas and hazel-nuts. This is spread from a cart with a shovel, and the men who do this work are so expert that they can make

an effective covering of the whole street (30 to 45 feet wide) with the use of only one load to the mile. In Fifth avenue, last winter, the contractor was restricted to the use of four loads per block, which would be 80 loads to the mile. There is no record of the amount used, but there is a vivid recollection in the Department of Street Cleaning that it was enormous. Probably the day is not distant when we shall have to sand at least our asphalt streets, and it is a comfort to know that the quantity of sand used need not constitute an embarrassment to the work of cleaning. It is to be hoped, too, that the example of Birmingham may be heeded by the managers of our street railways, which are now sanded with a wonderfully lavish hand.

Birmingham has a very large proportion of macadamized roadway, and it is of most excellent quality, well made, and *constantly* kept in repair. The work is done by the city's own force, and nothing is shirked. In minor streets the macadam is 21 feet wide. It is 4 inches higher at the centre than at the edges. The material is 20 inches deep. The bed is graded to a true form, and is rolled. The bottom layer, 8 inches thick, consists of *damp* ashes rolled. On this is placed an 8-inch layer of gravel or broken slag, also rolled. This is covered with "ragstone" or granite crushed to pass through a 2½-inch ring; this is rolled dry. This is covered with a "binding" of crushed grit, which is rolled in wet, but not too wet, and is worked into the stone as thoroughly as possible. This makes a capital road, which is easily cleaned by scraping, and by sweeping with the birch broom.

The most interesting part of the cleaning work of this city is that which has to do with the disposal of its wastes. Only about one-half of its population is supplied with water-closets. The other half still use out-of-door "conveniences." These are supplied with "pans," which are regularly removed. There are about 36,000 of these. They are cylindrical in shape, 18 inches in diameter, and 15 inches deep. Household slops are not emptied into them. The pans are removed once a week. The removal is at night, from 10 P. M. to 8 A. M. They are covered with closely fitting covers, and are carried in closed vans, which take

18 at a time, and which have a receptacle at the tail end, into which ash-tub refuse is emptied. The average weight of a van, when fully loaded, is about 8,500 pounds.

There are three well-equipped yards, adjacent to canals, to which the pans are taken. One of these I visited. The van starts out from the yard with 18 clean pans, which are left in the privies from which the used ones are removed. On returning to the yard the pans are emptied into tanks, and are then turned over to the washers, who see that each van is supplied with clean pans to take out. The vans make from three to five journeys a night. This collection employs 61 horses and 122 men.

For the collection of dry refuse from shops and from houses which are furnished with water-closets (where no pans are used) 33 horses and 66 men are employed. This work is done in the daytime. The total weight of the dry refuse collected is about 35,000 tons per year. In the emptying of ash-pits on private premises, of which a considerable number still remain, 40 horses and 74 men are employed. The material thus collected amounts to about 50,000 tons in the year. Much of this is valueless as manure, less than 20,000 tons being used.

The making of fertilizers is an important part of the work. The dry refuse is screened in rotating screens, which separate the fine ash from the coarser parts, from which tin cans, broken crockery, etc., are picked out by hand. Rags are not saved. Part of the fine ash is mixed as an absorbent with the contents of the pans, and is sold as manure, being run from the mixing-machines directly into boats. The demand for this is decreasing, as concentrated fertilizers are gaining in favor with farmers.

The combustible material, including garbage, is burned in destructors, or cremating-furnaces, of which the city has about 50 in operation. The heat of these furnaces generates steam, which is used to evaporate the moisture of the pan-contents, making a concentrated manure, and to furnish power to drive the mixing-machinery, etc. The refuse passed through the furnaces is reduced to about 30 per cent. of its original weight. The clinker produced is employed for various purposes. Much is used by

builders for concrete and mortar. It is also extensively used in road-making. As it is entirely free from offensive matter, it can be used without objection for filling low lands, for building roads, etc. The quantity burned in each furnace is given as 36½ tons per week (132 hours).

So much of the pan-contents as is not mixed with ashes and so sold is manufactured into a highly concentrated manure by evaporation. The raw material is emptied into tanks, where it is treated with sulphuric acid to fix the ammonia against evaporation. From these it is run into other tanks over the drying-machines. These contain pipes, which carry the vapors from the driers. The exhaust steam from the engines is similarly utilized, raising the contents of the tanks to near the boiling-point.

The steam-jacketed drying-machines consist of cylinders 8 feet in diameter and 13 feet long. Each has a hollow shaft, through which steam passes. They are also provided with revolving arms for stirring the contents and preventing them from forming into lumps. Suitable scrapers prevent the collection of drying matters on the surfaces. The foul vapor of the machines is arrested in a Liebig condenser. The water of condensation passes to the sewer in a nearly inodorous condition, and the gases are passed through the fire. After evaporation, the dried material is ground in a mill.

The working charge of the machine is 16 tons, and the dry manure resulting weighs about 1¼ tons. From 800 to 1,000 tons are produced each year. It sells for about $30 per ton.

By the statistics of 1892, the total refuse collected was 185,200 tons (of 2,240 pounds). This was disposed of as follows:

	Tons.
Sent to dumps away from the city by boats	16,753
Sent to dumps by carts	7,515
Burned in furnaces	74,243
Manure sold, or wasted at dumps	86,689
Total	185,200

The city owns and operates 34 canal-boats. None of the work is done by contract. It is found that under business management the agents of the administration can secure the greatest economy.

The items of receipts referred to in the early part of this paper do not include the sale of fertilizers. No reference to this is made in the annual estimates of the department. It is probably, like our own receipts from "scow-trimming," paid into the General Fund.

The chief lesson to be learned from Birmingham—and its methods are duplicated in English towns generally—is the lesson of non-political, non-shirking, and non-poor-man-coddling business management of public affairs. It shows us that a department of public works should not be a department of charities, and that—aside from proper and generous public charity—the money of the tax-payer should be used with the same care and economy that are so imperatively necessary to the successful management of private works.

A word of explanation is proper as to the "poor-man" element of the problem, and it applies to the question of public wages as well. The sympathies of all must be moved by the needs of the pauper class. The class that is obliged to work at hard labor is the happiest class in the community when it has employment, and sympathy for it should be limited to its fears for a rainy day, and to its unsatisfied laudable ambition to get ahead in the world. All must desire security and relief for the one and advancement for the other. The best way to secure these is through the general prosperity of the community. This cannot be advanced by favoring a special few who are lucky enough to get a place on the city pay-roll, at the cost of the multitude who have to pay the shot. Fair wages for honest work is all that a wise and beneficent government can properly give to any man from the public purse —unless he is a pauper who must be kept from suffering. Too good a chance for the poor man only crowds the ranks with those who flock in from abroad, and makes life all the harder for those with whom they come into competition.

BRUSSELS.

New York has about ten times the population of Brussels and about six times the amount of street to be cleaned. The cost of street cleaning in New York is $3,000,000; in Brussels it is $100,000 (500,000 francs). The cost per person of the population here is about $1.50; there it is about 50 cents. The cost per mile here is about $7,000; there it is $1,350. Wages here are $2 per day; there they are 50 cents per day.

Disregarding wages and making the comparison by day's work, we find that in New York the working force equals 5½ men per mile of street, while the Brussels force is 4 6-10 men per mile.

The work in Brussels is excellently well done, and the whole administration is good. It is all under the control of one Director, Mr. Smeyen, who has organized the entire service, and who has won great credit for it. The work comprises:

1. The sweeping of all the streets and public places, and the cleansing of the outlying park, "Le Bois de la Cambre."
2. The removal of all sweepings and house wastes.
3. Street-sprinkling, and the flushing of streets, alleys and courts.
4. The cleansing of sewer inlets.
5. The care of urinals.
6. Disinfection on the public highways.
7. The collection and removal of the wastes of the abattoir and of the fish-market.
8. The removal of snow and ice.
9. The sale of the collections for fertilizing, or their removal to a depot some four miles from the city, on the canal to the Scheldt.
10. The administration of the *personnel* of the service, the manufacture and maintenance of carts, tools, etc., the purchase of horses and forage, etc.

N. B.—It is forbidden to discharge any street sweepings into the sewer.

The department dates back to 1560, when the wastes of the

town were deposited at the point now occupied by the main depot. Since 1853 the work has been greatly improved and systematized.

The present station and the canal basin were completed in 1865. Formerly the street cleaning was done by a contractor, who paid the city for the privilege, selling the manure, etc., on his own account. The city received 6,960 francs in 1836, the amount increasing, until in 1846 it reached 26,940 francs. Later the work was taken in hand by the city, and the profit reached 75,505 francs in 1856. The construction and use of sewers soon reduced the amount of night-soil to be collected and sold, and as the sanitary condition improved, the financial returns fell off. The people, too, became more and more exacting in the matter of complete sweeping and better sprinkling, so that in 1858 there was a net outlay of 11,950 francs, which by 1865 had grown to 102,000 francs. This led the Council to let out the work for an annual payment by the city of 81,000 francs.

Experience showed that this was not a good plan. There was a perfect "deluge" of reclamations and of complaints of bad service, and public dissatisfaction became so great that in 1871 the city again undertook the work on its own account, with the satisfactory results that have continued until this day.

The limited size of the city allows the concentration of all the main appliances of the service at one point, the Quai de la Voierie, near the Custom-house, in the northwest part of the city. A large basin has been formed in connection with the canal, and the buildings of the department are separated from this by a broad esplanade. The carts, wagons, sweeping-machines and water-carts are stored in the building. There is stabling for the 80 horses used, the necessary storage-room and shops, and a "destructor" recently built on the English model. There are residences and offices for the Director and his staff, and the whole establishment has the well-kept air of a military post. Eight iron canal-bots constitute the removal fleet. These are loaded from the carts along the esplanade. The refuse is picked over by the men themselves, and they are allowed to sell what they cull out

for their own account. The sweeping of the streets is done mainly by hand, with the occasional accessory use of sweeping-machines, which work only at night. The city is divided into eleven sections, and the outlying park forms a twelfth. Each section has its Supervisor, who is responsible for all details of its work to the Director, who is in turn accountable to the Magistrate of Public Works.

The Supervisors work in accordance with certain general regulations, but they are allowed much discretion as to methods, as the conditions to be met are very various.

The work of sweeping, sprinkling, flushing and disinfection begins at four in summer and at five in winter. It continues, according to needs, until three or four in the afternoon. A half-hour is allowed for breakfast, and an hour for the mid-day meal. On Sunday, work ceases at eleven. The sweepers work in groups on the heaviest part of the work during the first two hours of the day.

At six in summer and at seven in winter the collection with the carts begins. The groups of sweepers are then broken up; about seventy of them are detailed to help the drivers to load their carts, and the others repair to their appointed routes, which they care for during the rest of the day. Some of them sprinkle the main streets, the boulevards and the roads of the Bois de la Cambre with the hose and jet. The streets are sprinkled throughout the day with water-carts.

For the collection of house wastes the city is divided into sixty-eight routes, each having its own cart, which makes two or three trips, according to distance. The carts take up the sweepings as they go. They are very large, and the loads average 2 4-10 cubic yards, which is about one-half more than the New York load. The house collections are finished about ten or eleven o'clock, except on Fridays and Saturdays, when they may last a couple of hours longer.

The sprinkling of the streets is mainly done by drivers selected from among those who have cleaned up their routes. In dry weather the sweepers sprinkle with the hose the spaces which

they are to sweep. This early sprinkling, the flushing of gutters, and the washing of courts, make it possible to delay the use of the water-carts until somewhat late in the day. It is estimated that from April to September one million gallons of water are used daily for the street service.

In each section one man has the care of the urinals; he is also charged with the disinfection of all places in his section which require such treatment.

The removal of the detritus of the abattoir and of the fish-market is, as far as possible, done at night, with covered wagons specially constructed for the purpose.

Concerning the removal of snow and ice, as I had no occasion to see its actual performance, I translate all that is said about it in the Director's memorandum of the service:

"To effect the prompt disappearance of snow, its melting is secured with the aid of salt, containing at least ninety per cent. of chloride of sodium. This salt costs about four dollars per ton.

"The use of salt has sometimes been criticised. Its use in Brussels is justified by its economy, and also because the city has in its territory not a single place where the snow taken from the streets could be piled; it would all have to be dumped into the covered river (la Senne) which lies under the central boulevards. Fourteen man-holes for this purpose have been built in the arch. The extraordinary work that has to be done in time of snow is the subject of a special organization, conforming to the depth of the fall. On such occasions the administration gathers all men out of work who are capable of holding a shovel or a broom. These are very numerous at this season of the year."

The collected wastes are offered for sale as manure at a tariff of prices fixed by the Administration of the Commune. It is mainly sent out in boats. What fails to find a purchaser is sent about four miles out on the canal and deposited on city property at Shaerbeek.

Assorted sweepings are offered "free on board" cars at Schaerbeek for forty cents per ton. Its agricultural value, by analysis, is two or three times this price. Another notice informs those

who live in the city or its suburbs that the department will furnish the same material by the cart-load at their residences; and that it is an "excellent manure for lawns, vegetable gardens, pleasure gardens and green-houses." The price is according to distance—the minimum being eighty cents per ton. The sales in 1894 amounted to $11,330, which was 12 per cent. of the net expense of the street cleaning service.

The authorities of Brussels have paid much attention to the question of cremation, to be applied not only to garbage and other offensive matters, but to the whole mass of material collected by the department. A commission was sent to England in 1887 to examine the methods there in use. They reported in favor of the adoption of the system then working at Leeds, this to be applied to all the wastes in times of epidemic. In the absence of this condition, only so much would be cremated as could not be sold.

The conclusions of the commission were the subject of a long discussion in 1891, and were adopted by a vote of 17 to 4.

The report of 1894 describes the installation of two furnaces built together, having a combined length of 37½ feet, a width of 14½ feet, and a height of 13½ feet. These furnaces stand near the stables on the north side of the yard, opposite to the weigh-bridge. They are found to answer a good purpose, and they are to be added to until capacity is secured sufficient for the incineration of the entire output in time of need.

A careful examination of the street cleaning organization of Brussels produces the impressions of great completeness and of most careful and successful administration. It is, taken all in all, the best thing of its kind that I found during my investigations. The reason for its success is not far to seek. It is the result of that "aristocracy in official affairs" that our politicians are wont to decry when they discuss civil service reform. It is due to the fact that every man in the service is assured of the stability of his position, and is safe in devoting his entire thought and energy to his work. "Rotation in office" and "the expiration of his term of appointment" do not disturb him. He need only do his work well and faithfully, and his future is assured. He is very ill

paid from our stand-point, but he can live comfortably on his pay, and he is well cared for and well thought of.

The benefit fund of the department in 1894 received from its members $1,272, the city added $1,228, and other receipts swelled the total to $2,837.

It paid to those who were sick, $1,970; doctors' fees, $343; medicine and surgery, $330; funeral expenses, $58; special aid to workmen, $91; expenses, $7.60—in all, $2,799.60.

"N. B.—The delegates of the workmen have had four meetings in the year 1894, in which they have been able to assure themselves that no expense foreign to the aims of the institution has been carried into the account."

MUNICH.

The only remaining places visited concerning which it seems to be worth while to give an account are Munich, Cologne, Turin and Genoa.

The work in Munich is noticeable chiefly for its negative qualities. The streets are kept in very fair condition, mainly by contractors, the city doing the work on asphalt streets—a limited area—and charging the cost to the property-owners. As a rule, nearly the whole service that is performed by the Department of Street Cleaning in New York is in Munich done by contractors employed and paid by private individuals. The street railway companies clean their own tracks and the space between the rails. This is done, and very well done, by sturdy young women. They wore, last summer, no distinctive dress, but were distinguished by a uniform straw hat.

Several regulations from the Police Ordinances of Munich will be interesting:

Police Ordinances* Relative to Keeping Streets in a Clean Condition.

* * * * * *

"Section 3.

"It is prohibited to throw building material and bricks into "the streets and thereby to raise dust.

"Whenever the first is inevitable, in the case of the tearing "down of buildings, the torn down material must be freely "flowed with water.

"Section 4.

"Freshly skinned or tanned hides and any and all kinds of "things which cause a bad odor or are repulsive to the eye shall "not be exhibited in streets or near public places or parks.

"Section 5.

"All matter likely to spread a bad odor or to dirty the streets "must be kept in well-closed receptacles until called for; gory "substances as well must be removed in the same manner.

* * * * * *

"Section 11.

"In cases when the streets, etc., may have been soiled through "the loading or unloading of goods and materials, as coal, turf, "sand, or littered with broken crockery or spilling of liquids, "and in general in all cases when the streets have been badly "soiled, they must be immediately cleaned again, especially in "the last mentioned instances.

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"Section 15.

* * * "With reference to Section 11, the Police have "the power to request that whoever littered the streets shall "remove the dirt caused by them."

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* In the Police Ordinances a special section makes property-owners and their representatives liable for the infringement of any regulations regarding the handling and disposition of refuse.

COLOGNE.

Cologne was a great surprise to me. I remembered its condition twenty-five years ago, and had had very little occasion to notice it since. I found it scrupulously clean—cleaner than any other place that I saw in Europe, not only in its central show parts, but in its outlying and more obscure quarters as well. My earlier observation had recalled Coleridge's lines:

> The river Rhine, it is well known,
> Doth wash your city of Cologne;
> But tell me, nymphs! what power divine
> Shall henceforth wash the river Rhine?

The "thousand and one stenches" for which the old city was noted have disappeared, and *eau de Cologne* no longer suggests a misnomer. The details of the method of work are similar to those of other Continental cities, and very similar to our own. The people seem to be well trained. Respect for the cleanliness of the streets has become a second nature. There is very little littering with paper and trash, receptacles are not set out long in advance of the arrival of the carts, and all of the details of the work and of the regulations by which it is directed are well thought out, well administered by the officials, and well received by the population.

The following details from the report of the Division of Street Cleaning of Cologne will be of interest in showing the manner in which each man is made responsible for a certain portion of the work:*

"1. Roll-Call.

"Two men in charge of the sprinkling machine must report "to the Inspector at the station-house at 9.30 P. M.; the rest of "the force, with their carts, must report only at 10.45 P. M.

"The Inspector orders the men to stand in a row in order to "inspect their uniforms. He calls the roll and makes entries in "the record-book concerning the men reporting or those absent "with or without leave, or for cause of illness.

* This method of detailing certain experienced men, in rotation, for each particular subdivision of the work, seems to be generally followed in Continental cities.

"Two men in charge of the sprinkling machine are fitted out "with leather aprons and a sufficient number of sprinkling cans. "They start off at 9.30; the sweeping machines start next at 10 "o'clock. The Inspector regulates the work as follows:

"2 men sprinkle the sidewalks.

"4 men sweep the sidewalks (2 men on each side).

"2 men sweep the gutters, one on each side.

"6 men shall cart the sweepings together in piles (3 men "on each side of the street).

"2 foremen and the rest of the men to put the sweepings "in piles.

"One-half of the men to clean the right and the other half to "clean the left sides of the respective streets.

"The men are ordered in turn to the different kinds of work. "The men in charge of the sprinkling machines are changed "around every day; the men who shall be on this particular duty "are informed of the fact that they shall have to report for this "duty on the following evening. The men in charge of the "carting are relieved every three days. The latter again take "the work in turns, so that each of the three men shall have to "take a push-cart during one of the three nights."

"Foremen excepted, all men shall in equal turns be ordered to "heavy duty, such as sprinkling and carting of the sweepings; "the most reliable men of the force shall have charge of the "cleaning of the sidewalks.

"When the men are fitted out with the necessary tools and "have been instructed as to their respective work, they draw up "in troops and march off in closed ranks under the guidance of "the Assistant Inspector, who takes them to the place where the "work shall begin. He must have care to have the gang move "on the roadway instead of walking along on the sidewalks.

"SPRINKLING.

"Description, handling and work concerning the shower and "Turbine watering carts.

"*A.* Description.

"*B.* Management of the Carts.

"*C.* The work (Extracts).

"In sprinkling streets and sidewalks the drivers of the sprink-
"ling carts shall observe a fixed route, and the sprinkling must
"be done in a sufficient manner to prevent the sweeping ma-
"chines, which follow the carts, from raising any dust, and the
"oldest of the men in charge of the watering cart shall in every
"case be held responsible for the sprinkling of all streets without
"exception. Streets or lanes that are too narrow to permit the
"passage of the carts must be sprinkled with hand cans.

"Molestation of the public in the streets, by means of sprink-
"ling water on them out of carts or cans, is strictly prohibited,
"and involves punishment. Any persons that may be in the
"passage of the men must be warned with a distinct call of 'Take
"'care!' and they have to be politely invited to make room.

"During day-time the sprinkling is done from 7 to 12 o'clock
"in the forenoon and from 2 to 7 o'clock in the afternoon, unless
"rain should rended the sprinkling unnecessary.

"The men in charge of each respective watering cart must be
"careful to sprinkle the streets in their full width and without
"any loss of time.

"Drivers as well as all the men must be neatly dressed and the
"horses must be in good trim.

"THE CLEANING OF SIDEWALKS.

"The men who are detailed to clean the sidewalks shall each
"be fitted out with a special broom, adopted for this purpose.
"Whenever sticky, viscous matter may cover the sidewalks (as is
"especially the case in Spring and Autumn), the men are to be
"furnished with brooms and scrapers in order to remove said
"matter.

"India rubber scrapers are to be used in rainy weather.

"The Inspector shall give instructions to the effect that these
"men, ordered to sidewalk duty, precede those who have charge
"of the piling up of sweepings; the distance between these two
"gangs must not, however, be excessive, as that would render

"the supervision a difficult matter. Sidewalks must be thor-
"oughly cleaned and special attention must be given to the clean-
"ing of house-lines along the walks and all corners around ad-
"vancing stoop-lines and pillars. These corners must be care-
"fully cleaned of all dirt. Special precaution must be had that
"no dirt be swept into cellar openings or into show windows that
"may be situated below or beyond the regular house-lines. These
"men shall also give an extra sweeping to the street-crossings be-
"tween the sidewalks that have already been swept by the sweep-
"ing machines.

"THE PILING OF SWEEPINGS.

"The men ordered to this work shall pile into little heaps, dis-
"tant one from the other by about 20 feet, the border of sweep-
"ings left by the sweeping machines. Places that have not been
"touched by the broom of the machine, such as holes between the
"paving stones and the street-car tracks, shall be swept by the
"men who have to form the heaps. Narrow streets and lanes
"that cannot be swept by machinery must be all hand-swept. The
"spacings between the paving blocks on particularly filthy streets
"must be swept over again in a line at right angles to the direc-
"tion of the street, so as to direct the dirt toward the gutters.

"This has also to be done regularly every day on cab-stands in
"order to remove the manure from between the rifts, as this can-
"not sufficiently be accomplished by machinery.

"THE CLEANING OF GUTTERS.

"Two men, one for each side of the street, are instructed to
"follow the route taken by the pilers, and to clean each his re-
"spective gutter down to the bottom from all dirt and slush
"which he adds to the sweepings already piled up in heaps.

"Care must be taken during rainy weather to prevent the
"slush from running into the catch-basins. Any one who shall
"deliberately sweep any dirt or slush into said basins or into the
"airshafts of the sewers will be irremissibly punished. Inspec-
"tors and foremen must immediately report any such violation.

"THE WORK DONE WITH PUSH-CARTS.

"One of the two men having charge of a push-cart shall con-
"duct the same; the other man is provided with a shovel (with
"a short handle) and a small hand-broom.

"These men shall put the little sweeping heaps into the push-
"cart and cart them away to some distance and dump them so as
"to form larger heaps. These increased dirt-piles must be de-
"posited on the roadways at well-lighted places, where they will
"not hamper the traffic, and, as far as possible, they should be put
"on the same spots always, in order that the horse-cart drivers
"who have to cart them away, may stop always at the same
"known places. Under no circumstances shall these piles be de-
"posited near street-crossings, and never nearer to a catch-basin
"than 3 or 4 yards distant.

"THE HORSE-CART SERVICE.

"The dirt piled up by the push-carts or deposited in special
"pits is carted away by the horse-carts and carried off to the
"respective dumping grounds. The Inspector keeps record of
"the time and number of trips made by the different carts and
"shall report accordingly."

TURIN.

Turin is very little behind Cologne in any respect. Its department is well organized, and here at last we found a distinctive street cleaner's uniform, regularly worn and regularly inspected, and kept in good order. In winter the men wear high-crowned felt hats; in summer their hats, of the same shape, were of mixed straw, producing a light brownish effect. The uniform is of a striped blue and white cotton goods, rather heavy, and rather given to fade under washing and exposure to the sun, but very good withal. The men trundle heavy hand-carts, after the manner of Vienna and Budapest, and the systems of collection and removal of sweepings are much the same. Turin covers a large area, and is the centre of an active traffic, which brings many

horses and mules into the city, in addition to the cavalry and artillery regiments stationed there. The ordinary work is done by one superintendent, eight foremen, 84 special sweepers, 100 ordinary sweepers, and such a number of auxiliary sweepers as the work of the moment may require. These are usually needed only in emergencies. The pay of the superintendent is 60 cents per day; of the foremen, 50 cents; of the special sweepers, 45 cents, and of all others, 40 cents. The requirements for admission to the department are a knowledge of reading and writing, and age between 20 and 30 years, robust health, and a certificate of good character. The men are retired at the age of 40. Promotions are made for merit or by seniority. The most striking feature of the work in this city is its very low cost. The population was given to me as 340,000. Yet the whole expense of the department is only 532,500 lire (about $96,000). This is divided as follows:

The Chief Inspector	2,500 lire.
Sweeping and carting	220,000 "
Sprinkling	85,000 "
Tools and material	25,000 "
The removal of snow and ice	200,000 "

There are in the city and its suburbs about 8,600 horses and mules.

The following extracts are taken from the "Regulations for "Removing Snow, adopted by the City of Turin in 1860, and "still remaining in force:"

"Uniforms.

"The Sweepers, upon being admitted to service, shall be pro-"vided with a uniform, of which they shall take great care."

"Duties.

"The Sweepers shall execute, with attention and care, what-"ever work is assigned to them by their superiors. There will "be assigned to them a fixed area of surface upon which they "will work. The allotment of surface thus provided for may, "however, be changed according to the exigencies of the ser-"vice."

"HOURS OF WORK.

"The hours of work shall be those established by the Munic-
"ipal Council at its session of January 11, 1894, with such
"change between 5 o'clock in the morning and 8 o'clock in the
"evening as may be required by the season of the year, with the
"following times of rest, namely: Two hours for dinner and a
"half-hour for each of the other repasts between the 16th of
"April and the 1st of October. An hour and a half for dinner
"and a half-hour for the one other repast between the 1st of
"October and the 15th of April."

"HOLIDAYS.

"Absence from work during the afternoons of holidays will
"be granted to a number of men, not to exceed one-half the
"force, or even to a smaller proportion, if the exigencies of the
"service shall require."

"PROMOTIONS.

"Promotion shall be made for merit and seniority. The
"selections of the Chiefs, Sub-Chiefs, detailed men shall be
"made, however, altogether with regard to the ability displayed
"in the conduct of the work by them.

"The Extra Sweepers shall be appointed to the regular force
"altogether by seniority, upon which occasion they shall be sub-
"mitted to a second medical examination, and those then found
"incapable shall be dismissed."

The regulations covering the removal of snow and ice specially divide the city into districts, and each district is further subdivided into sections. There is a detail of employees made for each section. The snow force is held in readiness from the beginning of November, as per these regulations:

"ART. 9. At the beginning of November all dispositions must
"be made so as to hold the force ready in case of a snowfall.
"For this purpose, first, the Chief Engineer of the Bureau of
"Works, or somebody acting for him, shall immediately begin

"an inspection of the material required and of the stations pro-
"vided for the disposition of the snow and ice. Second, there
"will at once be organized the force of men required for the
"service, and they will be assigned, with every possible detail of
"exactitude, to their several stations.

"Art. 10. Beginning with the 1st of December, and even
"earlier, if the cold weather shall set in earlier, there shall be
"maintained, night and day, in the proper places, a guard of two
"or more intelligent workmen ready for their service. Said
"workmen, in the case of a snowfall at night time, shall, on the
"approach of daylight, give notice to the several section fore-
"men of their district, in order that they may take the necessary
"precautions in time for the required work.

"Method of Snow Removal.

"Art. 14. As soon as notice has been received, as in Article
"10, or as soon as the falling snow shall leave the ground whit-
"ened by it, the entire personal force shall repair to their respec-
"tive stations.

"Art. 16. The removal of snow will begin at 7 o'clock in the
"morning and last until 11, with an hour for lunch, and be
"resumed at noon and continued until night, or until the
"removal of the snow. Whenever, however, it may be neces-
"sary, the work shall be prosecuted until 9 at night, or even until
"midnight, where the circumstances demand it, and that by
"means of whatever number of workmen it may be necessary to
"employ. The removal must be begun at the same time at all
"points in the city and boroughs practicable with the number of
"men employed. Measures will be taken, however, to greatly
"accelerate the work in those streets and public places and
"approaches to the theatres frequented by trade, or for pleasure.
"In the remote localities, in the case of great need, the removal
"can be deferred until the above-mentioned places have been
"freed from the snow.

"Art. 20. The transportation and disposition of the snow
"that is gathered shall be with the purpose of depositing it as

"far as possible in that part of the river beyond the limits of the "city, or else, when that is not practicable, by depositing it at "the mouths of the sewers of the subterranean aqueducts, or in "remote places.

"ART. 21. In all the streets where it is possible to deposit the "snow in the river, and where this can be depended upon, this "method will be adopted, as more speedy and less costly.

"ART. 22. In all the streets and public places where there is "a canal, or a wide subterranean sewer, the accumulated snow "may be deposited in these, in order that it may be carried off.

"ART. 30. In case that frosts should follow the snowfall, the "force shall be equipped with the necessary tools, such as picks "and mattocks for breaking up the ice and hardened snow.

"ART. 31. In all the public places in which ice might be "perilous, either to pedestrians or beasts, the force shall have, "as a duty, the scattering of sand upon these surfaces, and for "this purpose there shall be provided beforehand, in each of the "sections, a proper supply of this material."

Special rules affecting special sections are also in force.

GENOA.

Genoa differs little from Turin in its methods of street cleaning, and is not very far behind it in the matter of tidiness and cleanliness. Its condition, as I saw it, was very satisfactory, and Americans living there told me that it is always kept in good order. It is evidently fully up to the general European standard. The marvel of it all is that the cost of its work should be so little. The wages of the workmen, the highest being only 40 cents per day, would seem not to be sufficient to account for the fact that the contractor who does the whole work has recently entered on a new engagement for four years, at an annual cost of $40,000, under a contract beginning as follows:

"Chapter 1st.*

"*Object of the Contract. Duties of the Contractor. Personal "Service. Materials.*

"Art. 1. This contract has for its object: 1st, the work of "sprinkling and cleaning the streets, squares and other public "places, or places open to the public of the city, and of the ad-"jacent suburbs, and of private places subject to the easement of "public passage; the removal and the cleaning of lavatories, "fountains and of sewer catch-basins and similar receptacles; the "cleaning of sinks; the cleaning of the bed and shores of the "streams, the canals and the like; to keep all these clean and to "improve, by all similar means, the streets in front of habitations; "the cleaning of the streets, so far as it includes the removal of "material swept out of private houses, gateways and other pri-"vate property upon the public streets, the transporting away "from the city or to some designated locality all the sweepings, "dirt and other material thus collected, and its cremation when-"ever for motives of public health, the administration shall be-"lieve that to be suitable. The crematory furnace for this ser-"vice shall be furnished by the administration, but there shall "be in exclusive charge of the Contractor all the persons and "the combustible material, necessary for the cremation, as well "as the expense of maintaining said furnace.

"2d. The washing of all the streets and the squares of the city "and suburbs, as designated.

"3d. The removal of snow and ice from public places, or "places opened to the public, and from private places having an "easement of public passage, and in general, from the places in-"dicated.

"4th. Every other obligation imposed by present contract.

"Art. 2. The Contractor shall fulfill exactly all the services "contemplated in the present contract, observing their conditions "and prescriptions with scrupulous exactitude. The Contractor "shall, upon the execution of the contract, present a substitute

* From the "Contract for Sweeping, Washing and Sprinkling the Streets, the "Removal of Snow and Ice and related services."

" who shall become the principal in case of the death or failure or " any other impediment of the Contractor himself, saving always " the right of the administration, which the administration re- " serves to itself, of continuing said contract, or of entering into " it with another. The entrance upon the function of the sub- " stitute, whenever the administration shall not have believed it " necessary to set aside the contract, shall be without any need of " further formal approval of the administration, and it shall be " considered as an immediate continuation of that of the first Con- " tractor. He shall, therefore, be secured by the same surety as " his predecessor in the same contract.

" The administration hereby renounces all interest whatever as " between the substitute for the original Contractor, and the heirs, " successors or representatives of said Contractor, and cannot and " shall not be in any manner involved in any of said obligations. " In case of the death, failure, or otherwise absolute incapacity of " the Contractor, all payments, without distinction, due to the " complete liquidation of the contract, including those already set " aside, but not yet paid over to the Contractor, shall be made to " the substitute as soon as he has assumed regularly the continua- " tion of the work. The substitute must enter into the stipula- " tions of the contract; must announce himself to the Mayor, and " choose a residence or office, as provided in Article 19 of the " Civil Code. Both the Contractor and his substitute, whichever " is in function, must personally, or by somebody immediately " representing him, present himself every day, at the hour that " that shall be determined by the Mayor at the office of the Muni- " cipal Police, in order to receive whatever communications may " be considered in the interest of the service. The representative " of the Contractor must be a person acceptable to the Mayor. " There must be substituted for him another equally acceptable " person whenever the Mayor requires it.

" Art. 6. By sprinkling, the Contractor must understand that " light watering which is effected by the means of the sprinkler, " or other similar contrivance, in advance of the sweeping, in " order to prevent dust. By washing, however, must be under-

"stood that abundant use of water which is effected by means of "hydrants, hose, and other similar contrivances.

"ART. 7. * * * The Contractor is required to have "working tools in number not less than the following:

"40 hand-carts for gathering the sweepings.

"16 carts for carrying off the sweepings.

"100 shovels.

"200 brooms.

"10 hose-carts for washing the streets.

"10 hose-carts for sprinkling the streets.

"200 carriers, and finally all other equipments necessary for "the work."

The other different heads of this contract are:

Chapter 2, Sweeping, Disinfecting, Removal of Refuse from Slaughter-houses, Removal of General Refuse, Organic Animal Remains, Removal of Sweepings from the Suburbs, Final Cremation of Sweepings, and of Dead Animals.

Chapter 3, Machine Sprinkling.

* * * "ART. 21. The sprinkling must extend to every "portion of the surface of paved streets, and it must be repeated "and continued as often and as long as it shall be necessary to "prevent dust from rising from said surface." * * *

Chapter 4 covers the removal of Snow and Ice.

In this instance, the contract covers everything in regard to the work of the street cleaning office, including not only general sweeping and cleaning, but also the removal of snow and ice.

Chapter 5, Duties and Special Conditions.

N. B.—In Genoa, residents are permitted to throw in the public streets snow, not only from the sidewalks, but from the roofs and private property as well, whereas in Turin, the latter is specially prohibited, and the sidewalk snow only is considered. In Genoa the contractor also "shall break up and remove the ice "and hardened snow from the unpaved streets, and the icicles "from the adjacent walls and eaves of houses with necessary care "and dispose of it in the same manner as the snow above mentioned."

Here, as in Turin, there are two classes of police—one for the care of the public safety, and one for the maintenance of order. The latter, who guard the condition of the streets, wear natty cloth capes and long coats, both black, and ornamented with black braid. They are armed with light canes topped with a heavy metal head like a slung-shot. This or their dignified demeanor commands great respect.

IN GENERAL.

In reviewing the whole subject of European street cleaning as it came under my observation, the most important and suggestive consideration is that which concerns the relation of the people to the work, and, largely as leading to that, the manner in which the police intervenes to prevent the littering of the streets. The regulations in European towns are no better than ours. The laws and ordinances are substantially the same, but there is the immense difference that in Europe laws and ordinances mean something and are executed, while here they are treated as mere matters of form. The policeman in Turin would as soon think of letting a highwayman escape his notice and official attention as of disregarding a man who deliberately threw littering material into the street. I have seen policemen in Europe accost gentlemen, apparently foreigners, and politely but effectively request them to pick up a paper they had thrown away. I have seen policemen in New York—and the spectacle is observable at every turn—saunter in a dignified manner past a crowd of littering people, utterly unconscious of the fact that they were violating any rule or regulation, and apparently considering it beneath the dignity of their position to heed the suggestion of a citizen that they were not obeying their orders. Here lies, unquestionably, the great secret of the difference between our ways and European ways.

As to methods available for the improvement of the New York system, very little was observed. As a rule, our carts are better than theirs, being lighter and tighter; our brooms are probably better; and our methods of final disposition are quite as good,

owing, no doubt, to our much better conditions for dumping refuse. Indeed, the only country in which important differences were found was Austria. The method of separating wastes at the point of final disposition in operation at Budapest was suggestive of very important improvements available here. So in Vienna I found the best street-sweeping machine, the best sprinkling-cart, and the best snow-plow. All of these will be tried here, and adopted if found sufficiently better than what we are now using.

Another matter of especial interest to New Yorkers is that our system of street-sprinkling is entirely unique. So far as I could learn, the world has never before conceived of such a method—where only that part of the street lying in front of property whose owner pays the private contractor a sprinkling rate gets any sprinkling whatever, and where the volume of water used is regulated by the sweet will of the driver, without restraint from any official authority. In Europe street-sprinkling is always under the control of the authority by which street cleaning is regulated. It is a necessary and inseparable part of the same work. There is a proposition now before our Legislature to extend and to increase the street-sprinkling monopoly of this city. I trust that the people will insist on the defeat of this measure, and so avoid the further tying up of their interests in this respect with the financial interests of a street-drenching company with a pull—as at present. There is no more reason for farming out the work of sprinkling the streets than that of sweeping them. Both are functions of the municipal authorities, and should be kept under close control.

REPORT OF THE MASTER MECHANIC.

DEPARTMENT OF STREET CLEANING,
OFFICE OF MASTER MECHANIC,
NEW YORK, December 10, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—I beg to submit the following report of the work of the Mechanical Bureau for the three years of your commissionership.

THE MECHANICAL BUREAU IN JANUARY, 1895.

SHOPS.

You found, in January, 1895, mechanics stationed at Stables A, B, C, D and E. The main body, however, were at Stable A, Seventeenth street and Avenue C. At the latter place 5,300 square feet were given over to shops for keeping the Department's property in repair. This 5,300 feet was scattered here and there throughout the 50,000 feet of floor space of the stable itself. Harness-makers worked in one little squalid shanty, while carpenters, plumbers, tinsmiths and the like, worked in as many others, scattered, without system, throughout the building. The mechanics were mingled with the three hundred horses occupying the stable, much the same as the squatters and goats in Harlem fifteen years ago. The ten or twelve men scattered through the other stables I have mentioned, were mostly without proper supervision and did what might be expected under those circumstances. On January 1, 1895, there were employed in this repair work 61 men. Fifty-three were on the mechanics' roll and the remainder drivers "detailed." Thirty of the fifty-three mechanics are here now. Seven of them have been dismissed in three years, while the remainder are either dead or have resigned. It certainly is significant that with the great change in results, there should have been so few found inefficient.

As for power equipments there were a boiler and an engine which ran a blower for two forges, two small drills and a grindstone, a ludicrous foundation on which to commence the work at hand.

ASH CARTS.

You found Sixteenth street, for 350 feet east of Avenue C, encumbered with broken ash carts so that only ten of the sixty feet in width of carriageway and sidewalk was available for the use of citizens. Stable A itself was congested with these dilapidated vehicles, and the sidewalk display was only an overflow. While the money invested in these

two hundred carts [$20,000] was lying idle for want of a few repairs, the Department was hiring carts with which to do its work. Those carts in use were a sorry sight. They rattled at every clip and bolt. The steel bodies were rusted and the running gears unpainted and mud-stained. The Street Cleaning Department cart was typical of the whole business of street cleaning. The cart was necessarily dirty and disreputable, and it was useless to attempt to render its appearance less repulsive. In fact, with the painting methods and facilities then in vogue, a cart could only have been painted once in eight years, provided they were done in rotation. In other words, most of the carts must have worn out, never having received a brush full of paint after they left the makers' shops.

During the months of February, March and April, 1895, the mechanics worked one and one-half time, in order to get all of the Department carts into commission.

By May 1 this was accomplished, and the shops had, thereafter, only to keep up with the daily breakage, as far as the carts were concerned.

CARRIAGES.

The carriages used by the District Superintendents in the discharge of their duties were allowed to get into a condition which was a disgrace to the city. Instead of being kept in repair, they were allowed to go until they broke down completely, and then they were sold at auction.

DUMPING BOARDS.

Of the sixteen wooden dumping platforms which the Department then possessed, a few built not long before by the Department of Docks were in good condition. In most cases, however, the 3-inch spruce sheathing had been allowed to wear through, and in many cases the 3-inch yellow pine under-flooring was through in places. This left the ramp and board not only very uneven and hard on the horses, but unsafe in places. In all cases the portion of the board overhanging the water was built 3 inches lower than the rest (see Fig. 1), and led to a heavy strain on the horses when backing to dump the load.

The so-called guard-rails placed beyond the backing-log to prevent carts which ride over the backing-log from going into the river or scow were ludicrous in their proportions. After careful inquiry not one instance could be found where they had done their duty. The portable derrick for this purpose was in almost daily requisition to get horses and carts out of the boats. One horse was drowned at East Seventeenth street. The derrick is no longer needed for its original purpose, but is used for construction.

STABLES.

Stable A, the first and for a long time the only stable of the Department, was originally built and used for a public market. It is an

old building and can never be made a model stable. In January, 1895, its interior presented a hopeless confusion of shops, stalls, lumber, carts and rubbish. It had one large floor, 350 x 150 feet. The stalls drained into open wooden gutters, which gutters led, no one knew where, except

FIG. 1

that his sense of smell told him it was not far. The stall bottoms, gutters and floors were rotten and saturated with filth.

Stable G was an old rickety building of the worst sort. In its cellars where horses were kept there was no sewer connection, and the sewage had to be bailed out of a hole made in the earth floor.

The seven other stables were quite new buildings and in a condition which could easily be improved so as to make them models. The floors in all cases leaked and had to be calked; in some cases new floors were laid. Concrete floors were put in the basements and stalls erected on them to make room for the larger number of horses. New stall-gutters and plumbing were installed. The stall sides and heads were all cut

OLD GUARD-RAIL AT DUMPING BOARD.

down to four feet in height and iron guards placed on them, thus giving relief from the heat of summer. Feed rooms were built on the top floors.

THE MECHANICAL BUREAU, DECEMBER, 1897.

SHOPS.

The mechanics have been concentrated in two shops, one at Stable A, Avenue C and Seventeenth street, and the other at Stable D, One Hundred and Sixteenth street and Pleasant avenue. The main shops at Stable A now occupy 15,300 square feet of floor area, nearly three

times the space occupied in January, 1895. This extra 10,000 square feet has been gained by erecting mezzanine floors in the stable at an expense of $3,000. The capacity of the stable for horses has been increased by concentrating the shops and tearing down the old shanties. There are now 64 men on the mechanics' roll and 60 detailed men employed here.

New shafting has been erected and communicates power to a large blower (to supply blast to seven forges and a gas tire heating machine), four drilling machines, a power punch, a circular saw, an emery wheel and a grindstone. Two hand punches, a cornice brake, a shearing ma-

NEW GUARD-RAIL AT DUMPING BOARD.

chine, a vulcanizer, two tire benders, a welding machine and complete tinsmith's tools have been added.

The mechanics in the Harlem shops take care of the repairs for the Ninth, Tenth and Eleventh Districts. It has not been deemed advisable to absorb this shop in the Stable A plant, on account of the long distance required to haul material from the upper districts.

ASH CARTS.

Carts are now repaired as fast as they are broken. The supply of extra carts is such that it is never necessary to run a cart when it should be sent to the shop. All carts are painted at least once a year,

and some of them twice. The steel body is painted an ash color and the running gear a vermilion.

In the shops are made and repaired the steel scrapers used on the asphalt streets. Bag carriers, sprinkling cans and harness are each repaired in separate shops.

CARRIAGES.

Since the first year of your administration not a carriage has been sold at auction or otherwise. When one has become badly worn it is thoroughly overhauled and painted. It is turned out to all intents and purposes a new carriage. There are carriages now as good as new, which in January, 1895, were laid aside to await the next sale.

BICYCLES.

A separate shop is provided where the bicycle repairs are made. There are now over 100 bicycles in use, and a man is constantly employed on them.

DUMPING BOARDS.

Two gangs of men are necessary to keep up with the heavy wear on these structures. They are carefully inspected every week by a competent engineer, so that we keep ourslves informed of their safety independent of the Dock Board. The repairs are at all times kept up with the wear. When it is found necessary to take up the overhang for dredging the slip, to resheath the ramp and board, or do other work which would interfere with the carting, men are sent at night or on Sunday. So that now a dump is never "closed for repairs," as was the case frequently under former administrations. A guard-rail of iron knees supporting a 6 by 8 inches stick prevents the danger of an unmanageable horse backing the cart over the backing log into the boat. Two new boards have been built during the past year by us at a cost of $1,400 each, a saving of 20 per cent. to the City over a contractor's price, not reckoning the saving in time required to go before the Board of Estimate and of advertising for bids.

STABLES.

At stable A new offices have been built for the Stable Foreman and Master Mechanic. A new feed room has been erected on a mezzanine floor and new and larger store rooms provided for the Property Clerk. Iron gutters with iron covers have been placed in the rear of the 242 stalls. Four modern water-closets have been built and a large portion of the rotted wooden floor renewed. This building is the property of the City and should be cared for by the Department of Public Works. Much, however, remains to be done. An entire new drainage system, an asphalt floor and a new roof covering are the most pressing needs.

Pursuant to your order we have prepared and have now on file in this office, plans for the entire remodeling of this structure.

Stable G, in Hamilton street, is a new building erected during the first year of your administration on the site of the old one; it has three stories and a basement; in the basement are 52 stalls on a concrete floor; on the first floor is the Foreman's office and floor space for storage

STALL FOR STABLES
OF
DEPARTMENT OF STREET CLEANING

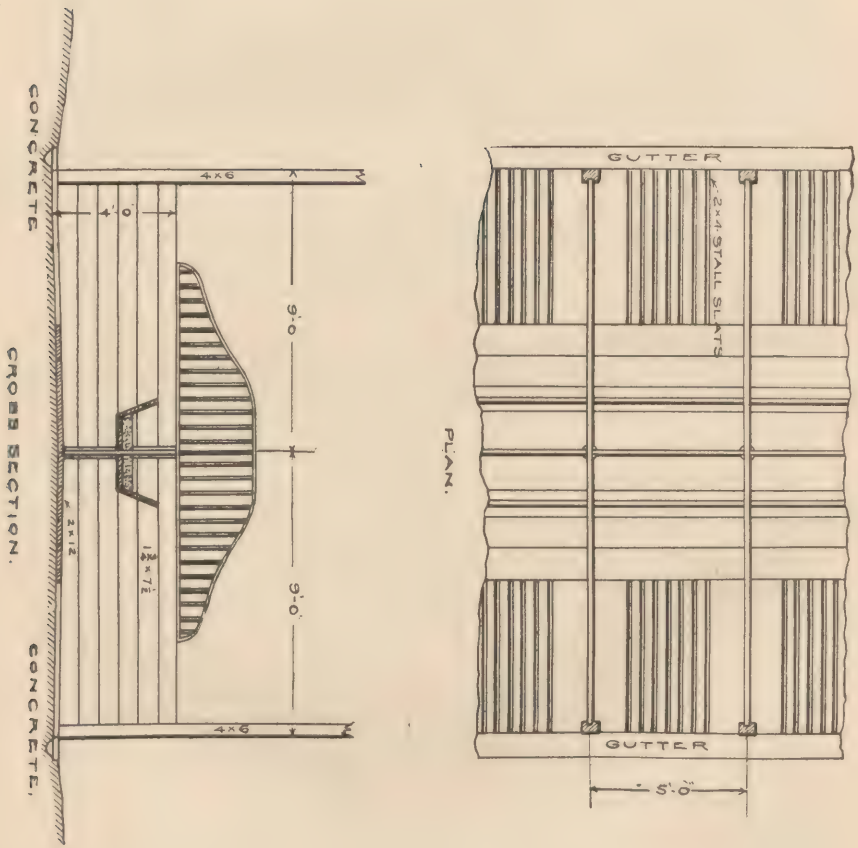


FIG. 2.

of carts; the horseshoers' shop is in the yard; on the second floor are 59 stalls on a water-tight flooring; the third floor is given up to a feed room, harness room, store room and harness-makers' shop; this general arrangement applies to the other stables hereafter mentioned with the exceptions noted.

Stable E, in West Twelfth street, has no stalls in the cellar, but 47 on the second and 39 on the third floor; a new office has been built for the District Superintendent and the Stable Foreman, two water-closets put in and a harness room built on the first floor.

Stable H, in East Forty-eighth street, has had a new drainage system and concrete floor placed in the cellar; on this floor were placed 37 stalls 9 feet long 5 feet wide, with 1¾-inch yellow pine siding 4 feet high, surmounted by a 2-inch by 2-inch cap and an iron ogee guard 2 feet 6 inches high; the concrete bottom is given a slope of 2 inches to the cement gutter in the rear; the gutter has a malleable iron cover, the 2-inch by 4-inch oak stall slats are held together by two bolts and taken up each morning to allow the floor to be flushed; these slats are put together in the shops and made of a standard size to fit any stall in the Department (see Fig. 2); feed and harness rooms were built on the top floors and an office for the District Superintendent; a water-closet was put in on the first floor, making two in the building; the 3-inch by 3-inch yellow pine flooring under the second story was recalked and pitched; the 56 stalls on this floor were cut down and iron guards put up, and in other respects they have been made to conform as nearly as practicable to our standard stall.

Stable B, in West Fifty-second street, has had a new drainage system and concrete floor placed in the cellar like that described for Stable H. On it were erected 44 stalls. The floor under the second story has been half renewed. The whole has been recalked and the 61 stalls on this floor remodeled, as described for Stable H. On the top floor there has been provided a harness-makers' shop, store room, feed room, drug room and closets for the Hostlers and others employed around the stable. About $2,500 has been spent in this work.

Stable F, in East Eightieth street, has been drained and concreted as described for B and H. In the basement were erected 48 stalls. An entire new floor has been placed in the second story. This floor is of 3 by 3 inches yellow pine, calked with three strands of oakum and pitched. On this were erected 55 new stalls. A new ⅞-inch yellow pine floor was placed on the third floor, and a feed, drug and harness-room built. A new water-closet was put in, making two in the building. The old runs from the basement to the first floor, and from the first floor to the second floor, and the stairway from the second to the third floor, were torn out and wider ones, with easier slopes, erected. This stable is now the best we have as far as the structure is concerned. About $5,000 have been expended in these improvements.

Stable D, in East One Hundred and Sixteenth street, has been recalked and pitched on the second floor. Shors have been installed on

the top floor and in the basement, where twenty-two mechanics and detailed men are employed.

At Stable C, in West One Hundred and Thirtieth street, a new concrete floor has been put in the cellar and 31 stalls erected. The second floor has been recalked and pitched where rotten. This stable was in better condition than any of the others when you took charge of the Department. On the second floor there are 64 stalls.

Stable I, in East One Hundred and Fifty-second street, has had a new drainage system and a new concrete floor placed in the cellar. On this have been erected 44 stalls. About one-third of the second floor has been renewed and new stalls erected, making 44 stalls on that floor.

All of the stables and Inspectors' houses at the dumps are painted and whitewashed once a year.

There are now 997 stalls in the nine stables of the Department (not counting Stable A annex), as against 875 in January, 1895. This is an increase of nearly 14 per cent. in stable capacity without increase in number of stables.

INCUMBRANCE YARDS.

In the yard at West Fifty-sixth street 9,000 square feet of sheds have been erected at an expense of $500. A water-closet and wash-bowl have been put in the custodian's house.

SECTION STATIONS.

There are now forty section stations throughout the city. All of these have plumbing which must be looked after. Closets, pegs for clothing and benches have been placed in all of them. A man is detailed to visit each of these stations at least once in two weeks and report any necessary repairs.

SCOWS.

There are 23 flat scows owned by the Department. All repairs which do not necessitate docking are done by the Department's own mechanics. A force of from three to five men is constantly engaged in this work.

WORK DONE BY DEPARTMENT.

For all of the work mentioned in the foregoing pages the Department depends solely on its own employees. The plans are drawn in this office and the work executed by the Department's mechanics under the supervision of the engineers who make the plans.

LIGHT REFUSE DISPOSAL PLANTS.

The old method of disposing of light refuse, such as paper, rags, packing-boxes, fruit crates, excelsior, old shoes, bottles, etc., by dumping it at sea outside of Sandy Hook, was a nuisance to the inhabitants of the Long Island, Staten Island and New Jersey coasts, as the in-

flowing tides brought the floating material back to the shore. To abate this nuisance, it was sought to dispose of the refuse by some method of burning it within the city which would do the work economically and without giving off smoke or smells which could annoy neighboring inhabitants. After looking over and investigating various plans and propositions it was decided in 1895 to try a system designed by Mr. A. W. Colwell, and a plant for this purpose was erected near the North river, between Fifty-second and Fifty-third streets. This plant consisted of an inclined wooden slat conveyor, about three feet wide, which had a slope of about 28 degrees with the horizontal. This carried the refuse up and delivered it into the top of the furnace, in which it was to be consumed. This furnace consisted of a common brick

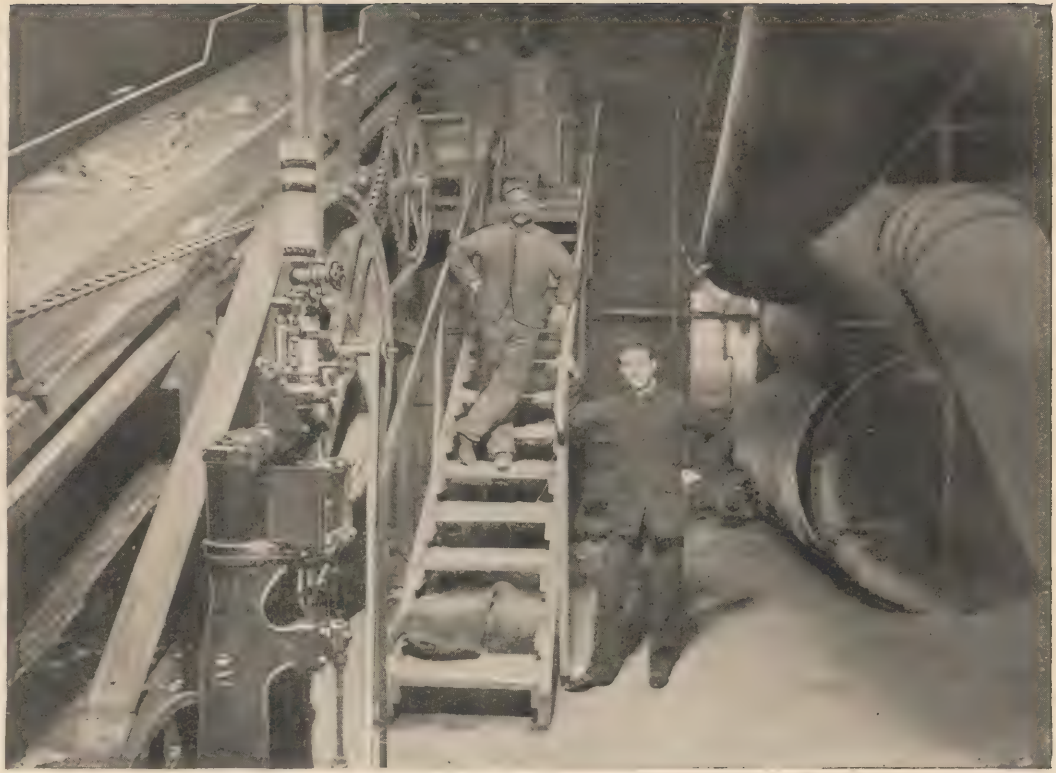
REFUSE DISPOSAL PLANT ON THE EAST SIDE.

shell, lined with fire-brick, and having a series of three grates, one above the other.

These grates were made of water-tubes, to prevent burning out, and were all connected with large tubes at the sides to give a continual current of water through them. The furnace was a down-draft furnace; that is, the air entered the top where the refuse is emptied in, and also at small openings around the sides, and the flame passed downward through the furnace and out at the bottom. At the bottom also was the ash-pit, from which the ashes could be cleaned every day. The upper layer of grate-bars were placed with wide spaces and the second layer

had narrower spaces, and the third layer still narrower spaces, so that the material as it became partially burned would fall through to a lower grate, so that each grate should have a fair proportion of the burning material upon it. From this furnace the hot gases passed through a horizontal boiler of about eighty horse-power, and from this they passed through a fan exhauster and thence through a dust separator to the stack. The exhauster was used to give the furnace a forced draft and force the smoke through the dust separator, which had helical plates inside to give the dust a rotary motion and throw the coarse dust to the outside where it could be cleaned out. In the operation of the plant the refuse was dumped from the carts on the elevator at the bottom, and as it passed up to the furnace all the material of any value was picked and sorted out by workmen stationed on both sides of the belt on stages. The material sorted out consisted of newspapers, manila paper, cotton rags, woolen rags, bottles, old shoes, rubber of all kinds, tin cans, barrels, and the different kinds of metals. Each material was kept by itself and sold to various dealers, the paper and rags being baled in hand presses. The material remaining after the sorting process passed into the furnace and was consumed; the hot gases were used to generate steam in the boiler, a portion of which steam was used in running the elevator and fan exhauster. This first plant showed that this method of disposal had many advantages over the old method, aside from the mere abating the nuisance arising from floating rubbish along the shores.

On this basis, early in 1897, a larger and more complete plant of similar design was erected on Eighteenth street, near Avenue C. This plant had an increased picking area by having a stitched canvas horizontal conveyor belt eighty feet long and four feet wide. This belt delivered the refuse upon the elevator and by having a line of pickers on each side, nearly the whole length, a very complete assorting was secured. The furnace in this plant was made larger than the previous one, but built in a similar style, except that the opening for the material was at one side, near the top instead of directly in the top. The fan exhauster in this plant was run by a two-cylinder direct-connected engine, and the dust separator was horizontal instead of vertical as before, and the stack was 105 feet high, while the first plant had a 70 feet stack. As the lease on the land where the first plant was erected was for a short time, the plant was taken down before the second one was built, and the boiler, engine, stack and part of the machinery were used in the second plant. In this plant the sorting conveyor is located in a long shed, while the boiler, elevator, furnace, exhauster, dust separator, engine and machinery are located in a fire-proof building about thirty by forty feet in area, constructed of steel frame covered with corrugated iron. There is also a wooden one-story storage shed, about fifty feet square, for bales of material, separate from the building in which the furnace is located, to avoid any danger from fire. This plant has been



CONVEYOR BELT AT THE EAST SIDE PLANT.

in successful operation since last May and gives off no objectionable smoke or odor.

To further extend this general method of disposal of refuse by burning it, plans have been prepared for a much larger plant, to be located in East Forty-eighth street. These plans provide for a plant covering an area 85 feet by 100 feet, and having a brick furnace building 55 feet by 35 feet, and the balance of the area covered with a shed having a steel frame covered with corrugated iron, a portion of it having two stories.

These plans provide for a receiving conveyor on the ground floor, upon which the material is placed when dumped from the carts and upon which a sorting of the heavier and more bulky material, such as tin cans, barrels and packing boxes, is made. This conveyor carries the refuse up to the second floor, where it is delivered upon a cross conveyor, which in turn transfers it to the long sorting conveyor, running almost the entire length of the building. From this conveyor all kinds of material of any value are sorted, and the paper and rags, which form the greater part of the material, are taken out, and thrown into hoppers, from which they are emptied into baling presses on the floor below. From these presses the bales are taken out and stored in the storage-shed until taken away by the various dealers. The refuse remaining after the sorting process passes into the brick furnace building, where it is piled upon a fire-proof floor above the furnace, from which it is taken at intervals to feed the furnace. The furnace to be used in this plant is a "Morse-Boulger" furnace; a type which has been in successful use for cremating garbage in various parts of the country. This furnace is an up-draft furnace, having two grates, one above the other, the fuel being emptied upon the upper grate. The hot gases from the combustion pass through a series of settling chambers, to take out the coarse particles of dust, and thence to the stack, which is about one hundred and forty feet high. A portion of the gases are taken through a bye-pass to a boiler of about 30 horse-power to develop steam for running the machinery of the plant.

This plant is to be larger and more complete in its details than the previous ones, and is expected to be capable of handling three hundred cubic yards of light refuse in ten hours. It is expected this plant will be ready for operation in the spring of 1898.

The conveyors and houses of the East Eighteenth street plant were designed and erected by the Department's engineers after the ideas of the Commissioner. The plant cost $16,000; the Department designed and executed $10,000 of the work.

STEEL STORAGE DUMPS.

Steel storage dumps were designed to meet the following objections to the wooden dumping platform:

First—They are not economical, in that the scow must remain under the board while the carts slowly load it. In the case of a Barney

SEPARATION OF WASTES AT THE EAST SIDE PLANT.

boat the City is paying $33 per day, while the boat remains under the dumping board, serving only for purposes of storage. It takes two boats in this way to "cover" one dump.

Second—To reach the necessary height horses must pull up a steep ramp with the loaded cart. This is a loss in horse flesh.

Third—They allow dust to blow into the streets after each cart discharges its load.

The accompanying views show the dump which was designed, at your direction, in an endeavor to meet these objections.

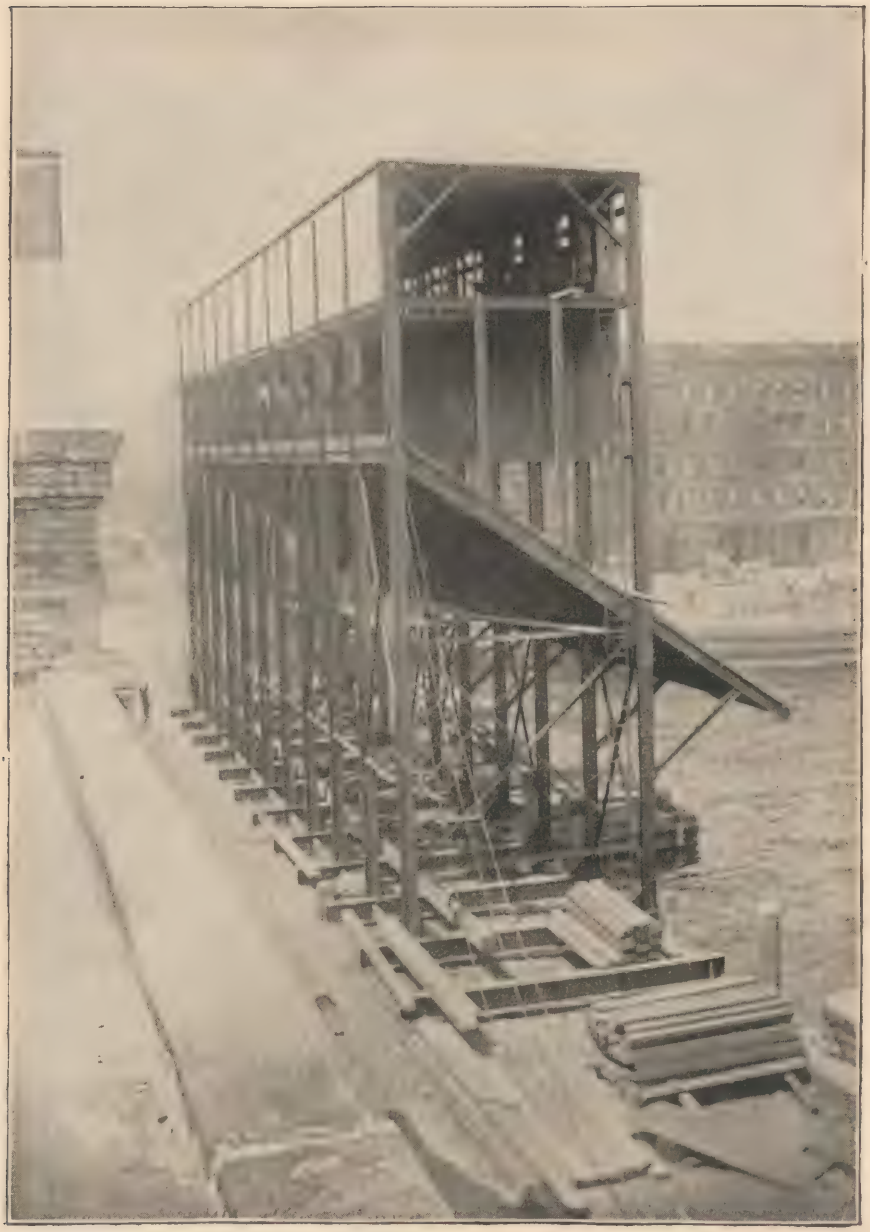
The first idea was to build pockets overhanging the water in such a manner that a scow could come underneath, the doors in the bottoms of the pockets be opened and the material discharged into the scow. The carts were to dump on to a conveyor which would elevate the material into the storage pockets. The Department of Docks objected to this construction and the matter was abandoned.

The idea finally settled upon was to have elevated pockets located on the pier. The floor of the pocket to be inclined and to extend in an apron over the boat. The material was to be elevated by a conveyor into the pockets. When the pockets were full the boat was to be placed under the apron, the doors of the pockets opened and the material allowed to slide down the inclined floor and apron into the boat.

At Seventeenth street and the East river such a plant has been erected, and others are in course of construction at One Hundred and Thirty-first street and Thirtieth street on the Hudson river.

The structure is 100 feet long and 16 feet 8 inches wide, centre to centre of columns. The pockets are supported on two longitudinal rows of I beam columns spaced 10 feet apart. The structure is divided into ten pockets by partitions at each transverse row of columns. Ten doors are provided on the outshore face of the pockets, running between the flanges of the columns and raised by winches placed on the upper conveyor platform. The floor of the pockets is 31 feet above the base of the columns on the inshore face of the structure, and originally ran at an angle of 35 degrees to the end of the apron. The end of the apron is 18 feet above mean high water. When the Delehanty boat was originally designed, it was to float light with the top of the pockets, 15 feet above the water. This would have left a clearance of 3 feet with a light boat at mean high water. The boat, however, floats 8 inches deeper than was expected. The conveyor and elevator is of the continuous, overlapping bucket type, built by the Link Belt Engineering Company, and especially designed to handle ashes and garbage.

Under the pockets and between the two longitudinal rows of columns which support the same, extend a series of hoppers, one under each pocket, sloping on their four sides toward a sliding door 2 feet square, through which the material, when dumped into the hopper by the carts, is fed by the pickers into the conveyor buckets beneath. The conveyor encircles the pockets passing under the hoppers, as aforesaid, up one end of the structure, over the pockets and down the other end,



STEEL STORAGE DUMP AT THE FOOT OF EAST SEVENTEENTH STREET.

making a complete chain. The conveyor buckets, after receiving their load, elevate it to the pockets above and are dumped by means of a dumping carriage, which moves in either direction over the pockets and will discharge at any desired point. An 18 horse-power engine runs the elevator.

The Seventeenth street steel pocket dump was first tried last August, and in the course of six weeks' running the following points have been developed:

VIEW OF THE SEVENTEENTH STREET POCKET DUMP, SHOWING THE ELEVATOR.

When drawing the plans some fear was entertained that the slope of the floor would not be sufficient to cause the material to run out when the doors were raised, but as there were no precedents to go by in the matter, it was thought best to make the slope 35 degrees, for if that was not found sufficient, it would be far simpler to increase it

than to make it less. It soon developed that the floor was not steep enough.

A false floor was built in one of the pockets and different inclinations tried until 42 degrees was found to be sufficient. Now the pocket floors are inclined at 42 degrees, but the apron remains at the original 35 degrees. Still the pockets do not always empty themselves clean when the material has stood for some time and become packed down. This latter is due to the arch which forms from the floor over the top of the doors. The wisdom of making the doors as large as we did is here shown. Many, from experience with ashes from power plants, insisted that a five-foot door was large enough, and some even advised smaller doors.

Also it has been found that when the doors are raised the material does not come out gradually, as would coal or steam ashes, but comes out in a body, giving a severe shock to the scow and loading it unevenly. It is hoped to remedy this by dividing the present pocket in half so as to discharge a smaller mass at one time and by hanging baffle boards from the roof of the apron, so that the material will strike them and fall vertically into the scow. The matter of the baffle boards is further complicated by the fact that tides and loadings make a difference of 9 feet in the vertical position of the top of the pockets of the boat.

To prevent the scattering of dust when the pockets are discharging, a corrugated iron roof has been placed over the apron. It would probably be well in the future to lower the end of the apron four feet. There would be times when the boat could not get under the apron at this height, but they would be few; and, on the other hand, the problem of properly loading the boat would be much simplified.

The doors are now raised by hand-winches. In future designs it would be better to place a shaft the whole length of the pockets over the doors. A clutch at each door would throw it into gear for raising. The power could be supplied by the boiler used for the conveyor, but probably it would be wise to install a separate hoisting machine.

The cost of one of these dumps, with conveyor, receiving-board and power plant, complete and ready for use, is $20,000.

In conclusion, I wish to acknowledge the assistance of Mr. Hunt, Mr. Crane and Mr. Daniel Curtin, Foreman of the Shops, in my efforts to execute your ideas and those of your Deputy in a way which would be worthy of your approval.

Respectfully submitted,

GEORGE L. WALKER,
Master Mechanic.

REPORT ON FINAL DISPOSITION.

DEPARTMENT OF STREET CLEANING,
BUREAU OF FINAL DISPOSITION,
NEW YORK, December 16, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—Up to the year 1894 the wastes of New York City, ashes, rubbish, garbage and street sweepings were disposed of simultaneously in either one of two ways.

The material dumped on barges at the various receiving places along the North and East rivers, was subsequently discharged either at sea or on tide lands which had been bulkheaded. The latter was the favorite method of disposal for two reasons. First, it was cheaper, and second, delays and blockades were far less likely to be caused by weather conditions than in the case of deposit at sea.

When used for filling land, the mixture of ashes, garbage, rubbish and street sweepings could only be deposited in the winter, and then covered, before the summer heat began, with dirt or clean ashes—unless, perhaps, the fill was in an uninhabitable neighborhood from which complaints to Boards of Health were not likely to arise.

The saving in cost by this latter method of disposition over deposit at sea was due to the generally shorter haul, the greater capacity of the barges in sheltered waters than at sea, and the unloading by machinery instead of hand labor, which must be employed at sea, except in the case of dumping scows.

The grave objection to the sea dumping was, of course, the defilement of the beaches of summer resorts along Long Island with floating refuse of all sorts. The removal of the place of dumping further from shore only transferred the nuisance from one point to another without mitigating it, and at the same time largely increased the cost of disposition. In 1894, when the place of dumping at sea was changed from the "Mud Buoy" to the Sandy Hook lightship, the average haul was increased about thirty per cent., entailing thereby a large increase in the cost of the transportation, but only transferring the shore nuisance to points further east on Long Island.

Formerly, depositing was done here during the entire year. Since April 10, 1894, deposit from April until October has been made outside Sandy Hook lightship, nine miles farther from shore than the "Mud Buoy."

The agitation aroused by the nuisance caused at Riker's Island during the summer of 1894, by the attempt to fill behind the bulkhead with

the mixed wastes of the city, resulted in the passage by the Legislature of the statute prohibiting the deposit behind bulkheads adjoining the waters of New York bay and harbor, of any material containing decayed animal or vegetable matter.

The Commission appointed by Mayor Gilroy July 26, 1894, to investigate the subject of garbage disposal for the city, made in November the following recommendations:

1. That dumping city refuse in any water of the harbor or its adjacent or tributary waters should be absolutely prohibited.

2. That the ordinance requiring householders to keep separate the

UNLOADING A DECK SCOW BY HAND LABOR AT THE "MUD BUOY" THREE MILES FROM CONEY ISLAND.

(The barge in the foreground is of the type usually chartered by the Department when it becomes necessary to hire scows.)

garbage or kitchen refuse from ashes and other house refuse should be rigidly enforced.

3. That all house refuse should be collected in galvanized-iron vessels with tight-fitting metallic covers, of such size that when full they can easily be handled by one man.

4. That daily collections of garbage should be made by the City, and delivered at the dump wharves into the temporary storage, or to self-propelling boats of some approved type, to be furnished by the party having the contract with the City for the final disposition of the garbage.

5. That the garbage should be disposed of by a reduction process, producing fertilizer and commercial grease; that the City should invite competition by the various companies controlling such systems, in order that the greatest benefit to the City may result.

6. That a separate collection should be made of the remainder of the refuse of the City, not otherwise provided for, which should be used for filling at Riker's Island, or elsewhere, and for the transportation of this material a sufficient number of self-propelling boats of an approved type should be constructed and owned by the City. It should, however, be provided that whenever the whole or any considerable portion of the street sweepings can be disposed of by contract or sale for fertilizing purposes at a price greater to the City than their value for filling, then such disposition should undoubtedly be made of them.

The investigation of methods of garbage disposal and the final selection of a system has been made the subject of special work and report by Mr. Craven.

I desire to report particularly upon the work thus far accomplished along the lines laid out in the sixth item of the recommendations of the Gilroy Commission and the prospects of future development.

During the entire year of 1895 practically the only method of disposal available was by deposit at sea. The normal equipment for accomplishing this work consisted of a fleet of thirteen patent dumping scows, hired by the City from the Barney Dumping-Boat Company of New York, 23 deck scows, owned by the Street Cleaning Department, and a number of chartered deck scows, which increased or diminished according as the work of deposit at sea was retarded or favored by the weather. This number of deck scows sank in summer, when the work was lightest and the weather best, to three or four, and in winter, when the work was heaviest and weather worst, rose at times to fifty or sixty. Rentals paid for chartered barges ranged from $4 to $6 each per day. The rental of the Barney dumping-boats was and is $30 each per day. It costs to maintain and supply the deck scows owned by the Department about $2 each per day, exclusive of supervision and interest on the cost of the plant. The unloading of these deck scows at sea, which can only be done by hand labor, costs on an average $33.50 per scow load of about 425 cubic yards.

The report of February 3, 1896, on the disposal of garbage, mentions a scheme by which the cremation of the mixed wastes was proposed, the ash residue to be used for land filling. As the scheme did not look promising, nor its backers give sufficient evidence that their proposition would effectively settle the matter of disposition, the scheme was rejected. The disposition of the ashes, street sweepings and rub-

bish then hinged, as did the question of garbage disposal, upon the separate collection of these materials, and investigation of methods of disposal were made on this basis in line with the recommendations of the report of the Gilroy Commission.

STREET SWEEPINGS.

The quality of the street sweepings of New York varies very widely in different sections of the city, the down-town and tenement districts naturally containing larger percentages of litter and rubbish than the sweepings collected in the residence districts. To determine the value of this material, samples of the average street dirt were taken from

SHOWS THE FLOATING DEBRIS LIABLE TO BE WASHED ASHORE.

(The cargo of the barges in this illustration consisted of ashes, street sweepings and light rubbish—no garbage.)

those parts of the city that are comparatively free from the litter of paper, straw, wood, etc., that occurs in many of the down-town districts. The result of the analysis of these samples is given in the accompanying report of Mr. Hawthorne Hill. It is evident from Mr. Hill's report that the manure market in New York is at present so over-supplied with the output of the City's stables, and that the fertilizing value of the street

sweepings is so small that, for a long time yet to come, there will probably be no demand for street sweepings large or steady enough to warrant their separate collection and storage for transportation to the country districts. The proportion of street sweepings to the ashes collected is not so large but that they may be mixed with the ashes for filling without any danger from the fermentation and decay of organic matter contained therein. Consequently, for the present at least, the cheapest and easiest way of handling the sweepings is to dispose of them in the same manner as the ashes and mixed with them.

ASHES.

In the appendix to the report of 1896 the industrial uses of clean ash have been commented upon, and another accompanying report of the same nature has been prepared by Mr. Koyl.

The ash received at the dumps of this Department is of two general grades: boiler ash, which is generally hauled to the dumps in private carts, and the ash from house stoves and furnaces. The Department now has no means of keeping these grades separate from one another. Even if there were provided storage for the steam ashes the demand for them is so erratic that the expense incurred in making arrangements for storing would hardly be warranted. For the present, at any rate, the easiest and the cheapest way for the Department to handle all the ashes is to utilize them for land development.

New York, from its location, demands water transportation of its wastes. Wastes that are adapted for land filling should certainly be used, as advised in the report of the Gilroy Commission, first of all for the development of land belonging to the City, such—for instance—as Riker's Island.

The placing of material behind a bulkhead at Riker's Island means, therefore, a consideration of methods of loading, transporting, unloading and handling in fill.

We have offered us broadly, either one of two methods of transportation. First, the one employed at present, namely, loading deck barges by the dumping of individual cartloads upon them and towing away the barges when loaded, by tug boats; second, the provision of storage so arranged as to permit the rapid loading of self-propelling boats which may continually ply from storage place to storage place until they have a full cargo, when they may run to the place of discharging. The amount of material received daily at the various dumps ranges from 350 or 400 cubic yards up to 1,000 or 1,200 cubic yards, in the case of two dumps, those at Canal street and Rutgers street, where work is carried on night and day.

If we are to use our transport boat as a storage place, loading it by the successive dumping of individual cartloads, it will obviously be cheaper, as far as the transportation goes, to use simple barges with one man in charge, than a steamboat carrying a crew of several men and

burning no small amount of coal, even when lying at the dump. The barges can be amply cared for by one man while loading, and the transporting power in a tow boat may be used to advantage in continually transporting.

If, however, instead of storing our ashes on a boat, we store them in a pocket or chamber which may be promptly and easily discharged, it becomes a question for careful consideration as to which system will be the cheaper and which will be the better.

At Riker's Island we have an area under water inclosed by a cribwork, alongside of which barges or steamboats carrying ashes and street sweepings may moor. At this point, then, we must consider, first,

GULLS FEEDING ON REFUSE UNLOADED FROM SCOWS AT SANDY HOOK LIGHTSHIP.

the discharge of the cargo; second, the distribution of the material in fill.

The handling of dredged material along water fronts has generally been done most cheaply by taking up the material, mixed with water, by pumps and delivering through pipes; the water acting as a distributing agent in connection with suitable changes from time to time in the location of the delivery pipes.

Observation of this method of handling material has led to the conclusion that it may be easily adapted to the handling of the ashes and street sweepings at Riker's Island.

If the material is to be handled dry it may be removed from the deck barges by crane and grapple and distributed by numerous systems of cars or carriers.

That a system which handles the material wet has advantages over one used to handle it dry, will be seen at once when the nature of the material is thoroughly understood. The fine dust of house ashes, the light street sweepings and the bits of paper which always find their way, with other odds and ends, into the ashes and sweepings, would, on windy days, render it well nigh impossible to handle such material without causing a nuisance which would be a repetition on a large scale of that now caused at our dumping boards by the carts as they discharge their loads into the boats. Furthermore, a fill made with material carried in suspension in water will compact, on settling, far better and be less liable to future settling and shrinking than one made by the deposit of dry material.

If the material is to be handled wet by some form of pump, it may be unloaded from either deck barges or dumping boats into a basin or receiver with which are connected the suction pipes of the pump. The easiest way, of course, to discharge a dumping boat is to dump it, and if a water basin is built large enough to receive dumping boats or scows and place them so that their cargoes may be respectively dumped or scraped off over the suction pipes of the pump, the cost of mere unloading will be reduced to a minimum for a transportation which employs either style of boat.

The designs of the storage dump and the self-propelling boat have had conditions imposed upon them by the nature of the material to be handled, which have been hard to fulfill, but whose difficulties have been thus far generally overcome.

The mixture of ashes and street sweepings, while free from large masses of rubbish and debris, such as mattresses, spring beds and cooking stoves, still contains an amount of paper, cloth, straw and wood, which causes trouble in the following way. The collection and packing of this material in a confined space for even a short period of time makes it necessary to consider any mass of the material to be handled not granular like coal or grain, but as a concrete, more or less readily broken up, according to the proportion of the elements it contains. Up to 1895 the only dumping boat capable of handling this material successfully was the Barney. The inventor of this boat had a very clear conception of what was necessary to provide for successful operation, namely, an opening at the bottom of the cargo larger than that at the top, a clear run of water through the centre of the boat when open, and the discharge of as much material in a single mass as possible.

These boats do their work well, but are adapted solely for sea dumping, as they will not dump when at rest on account of the tendency of the two hulls to close after the first weight of the load has been removed, and the lack of means to drive out floating matter confined in the space between the two hulls after dumping. They must

be kept continually under way, if they are to be properly cleared out. Another serious objection to their use is the tendency, after they are partly loaded, of the hulls to separate to a certain extent, thereby rapidly filling the slips at which they are used with material which escapes from the bottom.

The boat proposed by Lieutenant-Commander Daniel Delehanty, and designed and built by Lewis Nixon, manages these difficulties very well. The first boat built—the "Cinderella"—was faulty in many details. The nature of these faults was thoroughly investigated by actual trial. A detailed review of the changes made in this boat in order to overcome the difficulties encountered would be interesting, but too lengthy to give here. It is sufficient to say that they were corrected in

BARNEY DUMPERS AT "MUD BUOY" WAITING TO DUMP ON THE EBB TIDE.

the "Cinderella," and have been avoided in the two succeeding boats—the "Aschenbroedel" and "Cenerentola."

The conditions for dumping as large a body of material as possible at one point in still water have been met in these boats as follows: The compartments in which the load is carried, between the pontoons, are wider at the bottom than at the top. The width of the compartments on top is 10 feet, and the two bottom doors opening laterally are each 6 feet wide. The compartments are 13 feet deep and 15 feet long. This form of compartment does away with arching or bridging of the material in its downward passage and moves the mass more or less as a unit, according to the proportion of elements it contains, such as street sweepings, paper, etc.

The bottom of the divisional bulkheads of the compartments and the decks connecting the pontoons forward and aft are about 20 inches from the water when the boat is light. After dumping, the backing of the two propellers sends a powerful current between the two pontoons which, after the heavy matter has sunk, quickly drives out the floating material and permits the shutting of the doors.

In the design of a storage dump there were three ways of obtaining the desired result:

First—The dump might be built as an overhanging structure whose outer end might be supported by columns on piles, thus forming a passageway between the pier and the piles supporting the columns into which a steamboat could enter to receive cargo.

Second—The dump might be built as in the first case, but as a cantilever, with storage pockets in the overhang.

Third—The storage pockets or compartments might be built directly over the pier, but at such a height as to make it possible to give their bottoms a slope sufficient to discharge their contents into a chute grades: Boiler ash, which is generally hauled to the dumps in private when the compartment doors of the storage pockets were opened.

The same method of filling the compartments of the storage dumps might be followed in all three suggestions—namely, the use of elevators or carriers, as there is not sufficient room at any of the places where the dumps of the Department are located to allow the building of a run of such length as to permit the dumping of carts into the compartments of the storage dump in the same manner as they dump at present on scows. The overhanging dump also offers objections on the score of the liability of damage occurring to boats that would load under it, from the fact that the material dropped from the compartments would move in masses so large as to strike the boat beneath with a dangerous momentum.

Of the three styles of dump proposed the last is the cheapest, both as to first cost and maintenance. First cost will be cheaper since the loading of an overhanging structure on the cantilever principle will of course demand heavier iron work than where the load may be borne almost directly upon the main columns and floor beams. For an overhanging dump there must be employed at least two carriers or elevators, while a chute dump will require but one.

The details of design of this dump were influenced very largely, as were those of the boat, by the nature of the material to be handled. The conditions to be met were briefly as follows:

1. The storage compartments must be as large as consistent with the ease of handling the material.

2. The slope of the floors must be sufficient to readily start the mass in any compartment upon the opening of the door and break it up into particles so that its feed into the boat may be easily made and regulated.

3. The compartment openings must be of such size and shape as to prevent arching or bridging of the material during its discharge.

4. An elevating device of ample capacity must be provided so that the dumping of carts on the dumping platform may never be delayed.

5. A gear for the hoisting of the compartment doors must be provided, which may be operated by the same power running the elevator.

6. A chute must be provided for the proper feeding and discharge of the material into the compartments of the self-propelling boats.

The difficulties met in the operation of this dump have been chiefly in the securing of a slope of floor which, without seriously constricting capacity or increasing height, would be ample for the certain moving of

TWO BARNEY DUMPERS IN TOW IN ACT OF DUMPING.

the material in the compartments, and the providing of a chute which could surely and easily regulate the material as it is fed into the boats. These difficulties have not been hard to eliminate, but have been necessarily investigated and obviated by tentative methods which will no doubt soon show just what will be necessary for the design of devices which will do perfectly the work assigned to the dump. The conditions obtaining at the storage dump in the handling of ashes and street sweepings, prevail in much the same degree in the case of handling garbage. Illustrations and description of this dump are given in the report of the Master Mechanic, Mr. George L. Walker.

The self-propelled dumping boats were originally designed to carry 300 tons of material, be propelled by two engines, one in each pontoon of about 125 I. H. P., and to attain a speed when loaded of ten miles per hour.

This capacity indicated, and estimates on this basis showed a very large saving in transportation over methods now in vogue. The pontoon boat, while answering admirably the conditions asked for dumping in quiet water, appears to be of a form which the designers and builders cannot make attain the speed originally estimated. The steamer "Cinderella," with a carrying capacity of 300 tons, with two engines of 125 I. H. P. each, and propellers of 4½ feet diameter and 6 feet pitch, can under favorable conditions attain a mean speed of about 8 miles per hour. This means, under ordinary running conditions, a speed of about 7 miles per hour.

The second boat built, the "Aschenbroedel," is propelled by two engines, one in each pontoon, of about 250 I. H. P. each, with propellers of 7½ feet pitch and 5 feet diameter, and made on her trial trip a speed (the mean of light and loaded condition) of a little more than 9 miles per hour. This means a speed, under ordinary conditions, of about 8 miles per hour, which figure I have used in my estimate given further on.

The displacement of the "Aschenbroedel" is 50 per cent. greater than that of the "Cinderella," and the I. H. P. 100 per cent. greater. The actual bulk carrying capacity of the "Aschenbrodel" exceeds that of the "Cinderella" by about 15 per cent. The fact that an increase in power of 100 per cent. and an increase of displacement of only 50 per cent. results in an increase of but one mile per hour in the speed rate, seems clearly to indicate that for this type of boat a limiting speed has been reached.

The slight difference between the light and loaded speeds, a little more than one mile per hour, seems to indicate that the failure to attain a greater speed is due to interfering wave action between the two pontoons, as one of the 250 H. P. engines of either pontoon of the steamer "Aschenbroedel," would undoubtedly drive such a boat singly a rate of 12 or 14 miles per hour.

In making an estimate for cost of transportation we must, then, in determining the capacity of these boats, figure upon a mean speed not more than 8 miles per hour and a coal consumption for 500 I. H. P.

From the records of 1895, during which year all the material collected by the Street Cleaning Department was disposed of at sea in a mixed state, an estimate was made of the probable daily output of ashes and street sweepings after the removal of garbage and rubbish. The figure arrived at was 5,280 cubic yards per day for six days per week.

During the year 1897 an entirely separate collection of ashes and sweepings, garbage and light rubbish has been made. The records up to the present date show the following outputs of ashes and street

sweepings for the year: By Department carts, 780,000 cartloads; by permit carts, 270,000 cartloads—giving a total of 1,050,000 cartloads. This, reduced to cubic yards, is 1,627,500. This gives an average daily output for 313 days, of 5,200 cubic yards per day.

With the information we possess at the present date, from what trials and experiments have been made with the self-propelling boats like the "Cinderella," and with the storage dump at Seventeenth street, East river, I have prepared the following estimates of the future cost of

SCOWS AT DUMP, EAST SEVENTEENTH STREET.

(The upper right-hand corner shows a general view of the water front of the storage dump at Seventeenth street. Underneath the chute is an empty Department deck scow. Outside this scow, and farther back, is the first self-propelling dumper constructed by the Department—the "Cinderella." The photograph shows the pontoon form with the run of water between the two hulls.)

operation of the steamers, dumps and plant for the disposition of the ashes and sweepings at Riker's Island, with present methods that are available, in order to see what course it will be best to follow in future.

The work, as already noted, divides itself into three branches for whatever method is employed in handling and disposing of the ashes and street sweepings. These are namely:

A. Loading.
B. Transporting.
C. Discharging and handling in fill.

In comparing costs I have first compared the actual running expenses, including repairs, of the various methods considered, omitting fixed charges, such as interest, depreciation, royalties, etc., and then I have made a comparison including these items.

On this basis I have made comparisons of the three methods which may be most readily inaugurated in the Riker's Island work, taking care to use for each estimate the same or equivalent items of cost. Administrative charges I have omitted, as they would be a factor common to all methods.

I.

1. Loading from storage dumps.
2. Transporting by self-propelling boats.
3. Discharging and handling in fill by a pumping process.

II.

1. Loading from the present dumping boards into deck scows, the Department utilizing its own plant and chartering whatever scows, in addition to its own, may be necessary.
2. Transporting by tow boats, by contract.
3. Discharging and handling in fill by contract, the contractor selecting his own method.

III.

1, 2. Loading and transporting as in II.
3. Discharging and handling in fill as in I.

I.

A.—Cost of Operation Alone.

1. LOADING.

a. Labor—There will be needed at each of the storage dumps an engine-man for the operation of the elevating machinery; and at dumps where night work is done, extra men will be needed. The wages of these men will amount in the year to $13,500.

Experience at the Seventeenth street dump has demonstrated the necessity at that place of a gang of four Italian laborers to attend to the proper loading of the elevator buckets and the picking out of materials possessing value, as well as those liable to cause trouble in the elevator. Not a great deal of value comes in with the ashes and street sweepings. At the Seventeenth street dump, from 1,960½ cartloads

of ashes and sweepings the material culled was sold for $31.07. This gives a load value of $.016.

Laborers cost $1.25 per day. At this rate, using gangs of four at the thirteen dumps and two extra gangs of four at the dumps doing night work, will give a complement of 60 men, costing $75 per day. This cost will be partly offset by the value of the pickings from the ashes and street sweepings, which, on the basis just given, will be $54 per day, leaving a balance to be paid out daily for the labor of $21, or $6,600 per year. It is possible that this labor may become self-supporting, but the evidence before us at present does not seem to warrant our making such an assumption.

b. Fuel—The coal consumption at the Seventeenth street dump during its operation was 2,800 pounds pea coal for six days. For 13 dumps, allowing for night work and overtime, this will give us an annual coal assumption of 1,500 tons, costing $4,125.

c. Supplies—such as oil, waste, etc., and repairs to 13 engines at $20 each per month, will cost, per year, $3,120.

d. Repairs to Dumps—The repairs to the steel structures will be less than those at the wooden dumps. The elevating machinery will, however, need more or less repairing and supplying of parts that will wear out or break. As far as can be seen at present, an allowance of $50 per month, for each dump, appears to be fair. This will give an annual expenditure of $7,800.

Summary—For Operating Expenses of Loading.

a. Labor	$20,100 00
b. Fuel	4,125 00
c. Supplies and Repairs to Engines	3,120 00
d. Repairs to Dumps and Elevating Machinery	7,800 00
Total per year	$35,145 00

2. TRANSPORTING BY SELF-PROPELLING BOATS.

It is difficult to give an accurate estimate of the time that will necessarily be occupied in loading these boats from the storage dumps and discharging them at Riker's Island. The time of actual loading will no doubt, in many instances, be exceeded by the time lost in delays at crowded slips, by ice, fog, etc. For determining the time of loading, the operation of the dump at Seventeenth street has not as yet been such as to give any positive information as to the actual time needed to properly discharge the contents of one compartment of the dump into a compartment of the steamer.

It will, of course, be an aid to economy in the operation of this system to plan a schedule of the boats, so that they may always take from any one dump a certain maximum amount. The delays in getting in

and out of slips will be, as far as their location is concerned, a minimum at the up-town dumps, and a maximum at such dumps as those at Canal and Rutgers streets. In winter, delays from ice will be a maximum in the North river and a minimum in the East river.

Also, there are bound to be delays in the clearing of compartments of the storage dumps, when the material contains large percentages of rubbishy matter. The occurrence of this matter, which must be counted on, will also affect the time of discharge from the boats into a receiving-basin at Riker's Island. At this point, delays in unloading, besides that just mentioned, will be in the warping of the steamers in and out of the basin, occasional waits for unloading machinery to receive cargoes, ice, etc. In view of all these facts, I do not believe that an average time allowance for loading of two hours, and for discharging of one and a half hours, is at all excessive.

As already noted, the maximum speed attained by the boats upon which we can count in actual practice, is 8 miles per hour. The working capacity of the boats is 550 cubic yards.

In determining the efficiency of these boats and the consequent size of plant necessary to properly carry on the work, account must be taken of the fact that the output of ashes and sweepings varies according to the season as much as 25 per cent. each way from the average for the year, and that we may count on the maximum daily output, as far as it concerns the size of plant necessary to transport it, remaining practically constant for nearly five months of the year.

It will, then, be advisable to consider first, a plant capable of caring for the maximum output; then one for the minimum. Since the Department operates two dumps (those at Canal and Rutgers streets) night and day, I have considered one boat running twenty-four hours each day the entire year, and whatever others may be necessary, running on a twelve-hour basis.

The maximum output will be 6,500 cubic yards per day, of which 3,600 cubic yards will be from the East river, and 2,900 cubic yards will come from the North river dumps.

The average round trip from the North river dumps to Riker's Island is 31 miles; from the East river dumps to Riker's Island 12 miles. With these distances and the working speed of 8 miles per hour, allowing two hours for loading and one and a half hours for discharging, for each trip, we find that for the maximum period we shall need one boat running 24 hours and 4 boats running 12 hours per day.

The minimum output will be 3,900 cubic yards per day, of which 1,700 will be from the North river, and 2,200 from the East river dumps. Considering our working conditions as in the maximum estimate, we find that we shall need in addition to 1 boat working 24 hours each day, 2 boats working 12 hours. This will be the minimum complement.

Knowing the requisite size of plant, the cost of transporting may now be determined. The running expenses for a double crewed steamer will be as follows, per month:

Wages	$920 00
Rations	240 00
Coal	522 00
Oil and supplies	25 00
Repairs and painting	70 00
Total per month	$1,777 00

Total per year, $21,324.

For a boat running with a single crew, operating 12 hours of the day, the expenses of operation will be as follows:

Wages	$530 00
Rations	135 00
Coal	261 00
Oil and supplies	15 00
Repairs	50 00
Total per month	$991 00

Total per year, $11,892.

We have seen that for the maximum period of work we need a fleet of five boats, one working 24 hours and four working 12 hours per day; and for a minimum period of work we need three boats, one working 24 hours and two working 12 hours per day. Now, as already noted, the maximum condition of output prevails for practically five months of the year. The minimum period prevails for about two months. Then our fleet must work as follows: For twelve months of the year a double-crewed boat working 24 hours each day must be on duty. In addition to this there must be on duty for five months 4 single-crewed boats; for five months 3 single-crewed boats; for two months 2 single-crewed boats.

Summary for Operating Expenses of Transportation.

1 double-crewed boat, 12 months, at $1,777 per month	$21,324 00
4 single-crewed boats, 5 months, at $991 each per month	19,820 00
3 single-crewed boats, 5 months, at $991 each per month	14,865 00
2 single-crewed boats, 2 months, at $991 each per month	3,964 00
A total per year of	$59,973 00

Say, $60,000.

I have considered using but one double-crewed boat, as that will amply care for the dumps which work at night. The working of another boat day and night means the necessity of keeping at certain dumps a night operating force. Now assuming that a 24-hour boat will do just twice as much work as a 12-hour boat, we have for the saving

in cost of operation of a 24-hour boat over two 12-hour boats, $205 per month.

The night maintenance of three dumps (the least number outside of those at Canal and Rutgers streets), necessary to successfully operate a second 24-hour boat, would easily cost in labor and coal for keeping steam, more than this difference, as will be seen by referring to the estimate for the cost of operating the storage dumps.

3. DISPOSITION AT RIKER'S ISLAND,

By Depositing Material in a Receiving-basin and Pumping Material Ashore.

In present engineering practice there are two methods of pumping solid matter carried in suspension in water. One is by the centrifugal pump which will handle, with the water it elevates, solid matter in varying percentages, according to its character. The other method, commonly called the pulsometer, utilizes the pressure of the atmosphere to fill a chamber with which a suction pipe is connected, with a mixture of water and the solids to be handled, from which the mixture is forced through the delivery pipes, by steam admitted into the chamber under pressures varying with the length of delivery pipe, height of fill, etc. The steam in the chamber is then condensed by a water jet, a partial vacuum created, the chamber filled with a mixture of colids and water by atmospheric pressure and the process just described repeated.

Far more work has been done, and far more reliable data are obtainable in the handling of dredged material in the case of centrifugal pumps than in those instances where the other method has been employed. However, as regards handling the material collected by the Street Cleaning Department, we unfortunately have had no opportunity to compare the relative merits of these two methods. We do know, however, that the chief cause of delay and stoppage in plants handling dredged material by the centrifugal pump is the clogging or breaking of the impeller vanes of the pump by large objects that are drawn into the suction-pipe. The delays in the other plant are chiefly due to the tendency to force through the delivery-pipe mixtures containing too large a percentage of solid matter, thereby clogging the pipe and necessitating pipe cutting and clearing of the obstruction.

As regards economy of operation, the users of each system are inclined to belittle the results obtained by users of the other, and useful comparisons on this point are extremely difficult to make, owing to the lack of uniformity of conditions prevailing in the places where the various plants have been used or are in use to-day.

In choosing between these two methods for handling the material (ashes and street sweepings) which this Department intends to place behind the crib-work at Riker's Island, the factor most important and, indeed, almost alone in deciding the question, is the nature of the material. While it is proposed to transport and handle in this way only the ashes and street sweepings, there is always mingled with them such

a large amount of debris, as wood, rags, large and small pieces of metal, wire, rope, stones, etc., that it is evidently necessary for handling such matter by pump to have suction and discharge-pipes as large as possible, and the pump itself as devoid of details liable to injury as it is possible to make it.

Of the two systems mentioned the pulsometer or vacuum pump certainly meets the conditions more fully than the centrifugal pump. The design of a plant of this kind for use at Riker's Island must be for one in duplicate in as many parts as possible in order to guard against delays by reason of stoppage or breakdown, and must have a capacity for handling the maximum daily outputs in 12 hours.

Estimates from the builders of the machinery requisite for such a plant show that $50,000 would be necessary for building and equipping it. The cost of operation of such a plant is easily estimated as far as labor goes, but not as regards a very important item, namely that of fuel. Similar plants at work to-day, though on far smaller scales than what would be necessary at Riker's Island, are generally operated in connection with a dredge or steam shovel, the pump and dredge gear drawing their steam from the same source, so that it is hard to say just how much coal will be necessary, per unit of material per unit of distance delivered. One plant was seen where about 2,000 cubic yards, measured in fill, were dredged and pumped ashore 500 feet with a 5-foot lift on 5 tons of coal, or for this distance, 2½ tons of coal per thousand cubic yards, measured in fill.

As the lift at Riker's Island is practically nothing and the delivery can be made for a long time at very short distances, it seems to be safe to say that an allowance of 2 tons of coal per 1,000 cubic yards put ashore will be sufficient.

On this basis the cost of operation of the plant will be as follows, per year:

Summary for Cost of Operation of Discharging.

Labor	$14,400 00
Fuel	9,500 00
Rations for crew	3,600 00
Supplies and repairs	1,500 00
Total per year	$29,000 00

We now have as a summary of our first method of loading, transporting and discharging and handling in fill the following figures:

Loading	$35,145 00
Transporting	60,000 00
Discharging and filling	29,000 00
Total per year	$124,145 00

B. COST OF OPERATION WITH FIXED CHARGES.

(Interest, Royalties, etc.)

In computing the cost of the plant just described we must add one more boat to the complement needed for actual operation, as it will always be necessary to have a spare boat for emergencies. This boat need not be commissioned, but may be kept in readiness to receive the crew from any boat that may be temporarily disabled. Then 6 dumping boats, at $40,000 each, will cost $240,000. The structure and machinery for the storage dumps will cost per dump $19,500. This amount is divided as follows:

For structure	$10,318 00
For elevator, engine-boiler and boiler-house	7,500 00
For cart run	1,000 00
For wood-work and minor equipment	650 00
Total	$19,468 00

These figures are furnished by the kindness of the Master Mechanic, Mr. George L. Walker.

Thirteen dumps supplied with such structures will give an outlay of $253,500. Royalties to the inventor of the dumping boats at $10 each per day while the boats are in use will amount to (on the running schedule given in the cost of operation of the boats) a yearly sum of $13,800.

Then we have cost of boats	$240,000 00	
Interest at 3½ per cent		$8,400 00
Depreciation at 5 per cent		12,000 00
Insurance at 2 per cent		4,800 00
Cost of dumps	$253,500 00	
Interest at 3½ per cent		8,870 00
Depreciation at 2 per cent		5,070 00
Cost of pumping plant	$50,000 00	
Interest at 3½ per cent		1,750 00
Depreciation at 10 per cent		5,000 00
Royalties to patentees, per year		4,070 00

Summary of I., B.

Summary of I. A	$124,145 00
Royalties on dumping boats per year	13,800 00
Interest on cost of dumping boats	8,400 00
Depreciation of dumping boats	12,000 00
Interest on cost of storage-dumps	8,870 00
Depreciation of storage-dumps	5,070 00

Interest on cost of pumping plant	1,750 00
Depreciation of pumping plant	5,000 00
Royalties on pumping plant	4,070 00
Total	$183,105 00

II.

A. Cost of Operation Alone.

1. Loading.

a. In handling simply the ashes and street sweepings, it will be fair to say that in the light of present experience at Seventeenth street the labor of trimming the deck scows at each dump will cost as much as caring for the material dumped into the storage dump's elevator buckets. This was computed for the year at $6,600.

b. The only other cost incurred at the wooden dumps now in use by the Department will be for repairs and supplies, as the ashes and sweepings are dumped from the carts directly on the scows, the barges acting in the same capacity as the storage dumps in the preceding estimate.

The records kept by the Master Mechanic, Mr. Walker, and kindly put at my disposal, show an annual expenditure on the present dumps of $3,300 for labor and $1,000 for material, a total of $4,300, or $27.50 per dump per month.

Summary for Loading.

a. Labor	$6,600 00
b. Maintenance of dumps	4,300 00
Total per year	$10,900 00

2. Transportation.

The loading of deck scows for handling material for filling-in places has shown that we can, on the average, safely load a deck scow, taking the varying sizes as they occur in New York harbor lighterage practice, with 500 cubic yards of ashes and street sweepings. With an average daily output for 313 days of 5,200 cubic yards, we shall have a daily output of 5.8 scowloads from the East river and 4.6 scowloads from the North river; a total of 1,815 scowloads annually from the East river, and 1,440 from the North river.

Scows from the East river can be towed to Riker's Island and returned to the city dumps, by contract, for $10 per scow, and from the North river for $12 per scow. At these rates the towing will cost $36,180.

For doing this work 40 deck scows will be required under ordinary conditions. This means the hiring of 18 deck scows, the Department owning 22. These scows may be chartered at $5 each per day. This will give a yearly rental bill of $32,850.

At certain times the number of chartered deck scows must be increased by reason of delays in work from ice, fog, storm, etc. In 1895–1896, when work was carried on entirely at sea, although the larger portion of the work was done by the Barney dumpers, this extra hiring above the normal was nearly $30,000. On inside harbor work, where delays are rare from storm, and not nearly as frequent by reason of fog as when sea work is done, and where the time of transit is shorter, a total allowance for scow hire of $40,000 will be sufficient.

In 1895–1896, which was a hard winter, $9,541 was expended for shifting scows and breaking ice in the slips at the dumping boards. Shifting will always have to be done to a greater or less extent in using deck scows, and conditions of ice are so likely to arise in winter that an allowance of $9,540 for these items is certainly not too large.

The records of the Department for 1896 show for maintenance of the Department's fleet of deck scows the following items:

Material used in repairing	$1,486 08
Labor	3,847 09
Supplies	1,869 17
Total	$7,202 34
We may use, in round numbers, for an estimate	7,200 00
For 1896, the wages of Department scow men were	12,509 47

Summary for Transportation.

Towing	$36,180 00
Hiring	40,000 00
Maintenance of 22 deck scows	7,200 00
Wages of Department of Street Cleaning scow men	12,510 00
Total	95,890 00

3. DISCHARGING AND HANDLING IN FILL.

The prices obtained in the past for "Towing and Unloading," show that by contract work, the contractor selecting his own method, the Department can certainly have the ashes and street sweepings unloaded from its barges at Riker's Island and distributed in fill for not more than 7 cents per cubic yard. This would be for 1,627,500 cubic yards, the yearly output, an annual outlay of $113,925.

Summary of II., A.

Loading	$10,900 00
Transporting	95,890 00
Discharging and filling	113,925 00
Total	$220,715 00

B. COST OF OPERATION WITH FIXED CHARGES.

The value of the dumping boards, as existing at present, may be fairly put at $26,000. Interest on this amount at 3½ per cent. is $910. Depreciation at 3 per cent. will be $780.

The value of the scows, assuming them newly built, would be $92,000. Interest at 3½ per cent. will be $2,760.

Summary of II., B.

Summary of II., A	$220,715 00
Interest on cost of dumps	910 00
Depreciation of dumps	780 00
Interest on scows	3,220 00
Depreciation of scows	2,760 00
Total per year	$228,385 00

III.

A. COST OF OPERATION ALONE.

1. LOADING.

This is the same as II., A. 1, $10,900.

2. TRANSPORTING.

This is the same as II., A. 2, $95,890.

3. DISCHARGING AND FILLING.

In this item the cost of discharging and filling will be more than in I., A. 3, for the obvious reason that the material transported on the deck scows must be removed from the deck to the suction-pipes of the pump, while in the first case the dumping boats deposited their loads directly over the suction-pipes of the dredge, thereby necessitating an amount of dredging only sufficient to keep the suction-pipes well supplied with material. Now the deck scows may be unloaded by scraping their cargoes from the deck into a receiving-basin where the suction-pipes of the dredge are located, or by picking up the material by buckets of a suitable type, and dropping the material into receiving hoppers from which the dredge's suction-pipes lead.

How much this work will increase the cost of discharging and filling over that given under I., A. 3, is hard to say, as so many devices may be conceived for the prompt discharge of cargo from the deck scows to the suction-pipes of the dredge. I do not believe it will be too large to say that it will increase the cost of handling in the neighborhood of 50 per cent., or raise it from $29,000, as given in I., A. 3, to say, $45,000.

Summary of III., A.

Loading	$10,900 00
Transporting	95,890 00
Discharging and filling	45,000 00
Total	$151,790 00

B. COST OF OPERATION, INCLUDING FIXED CHARGES.

Summary of III., A	$151,790 00
Interest on cost of dumps	910 00
Depreciation of dumps	780 00
Interest on cost of scows	3,220 00
Depreciation of scows	2,760 00
Interest on cost of pumping plant	1,750 00
Depreciation of pumping plant	5,000 00
Royalties on pumping plant	4,070 00
Total	$170,280 00

Comparison.

	I.	II.	III.
A	$124,145 00	$220,715 00	$151,790 00
B	183,105 00	228,385 00	170,280 00

Rates per Cubic Yard of Material.

	I.	II.	III.
A	.076	.136	.093
B	.112	.140	.105

Up to the present time the most economical method of disposing of ashes and sweepings at the command of this Department has been by the deposit at sea from the Barney dumpers. In 1896 these boats car-

ried to sea 1,487,700 cubic yards. The expense incurred by the Department in this work was—

For hiring boats	$137,820 00
For towing dumpers	61,071 49
Giving a total of	$198,891 49

—or a rate per cubic yard of $0.134, omitting the portion of maintenance and depreciation of dumps chargeable to these boats for their use of the dumps (about $2,000 for the year).

In 1896 the cost of final disposition of the ashes, rubbish, street sweepings and garbage handled by the Department put on the same basis as the estimates prepared under I., II. and III., was made up of the following items:

Towing Barney dumpers to sea	$61,071 49
Towing deck scows to sea, shifting and ice breaking	53,137 50
Hiring Barney dumpers	137,820 00
Hiring deck scows	20,788 00
Towing and unloading deck scows at filling-in places	29,175 12
Unloading deck scows at sea by hand labor	51,881 65
Maintenance of scows	7,200 00
Wages of scow men	12,510 00
Maintenance of dumps	4,300 00
Total for the year	$377,883 76
Or in round numbers	377,900 00

This gives a rate per cubic yard of $0.146.

The material cared for was distributed as follows:

At sea in Barney dumpers	1,487,700	cubic yards.
At sea on the deck scows	785,900	"
In fill behind bulkheads on the deck scows	318,400	"
Total	2,592,000	cubic yards.

It will be seen from these figures that depositing the material behind the bulkhead at Riker's Island will be much cheaper than depositing at sea, no matter what system of loading, transporting and discharging and filling is adopted to carry on the work behind the bulkhead.

At Riker's Island, behind the existing crib-work, is an area of 65 acres capable of receiving about 2,000,000 cubic yards of ashes and street sweepings. In addition to this area there are, inside the bulkhead line located by the Secretary of War, 221 acres of submerged land

capable of receiving about 6,500,000 cubic yards of filling. These areas would give space enough to absorb the City's output of ashes and street sweepings for over five years, at the end of which time the City would possess about 285 acres of land, which would probably be worth over $500,000.

A review of the costs of transporting alone, omitting the cost of loading and the fixed charges, shows a large difference in favor of the self-propelling dumping boats. The excess of the total cost of disposition by System I. over that by System III. is due to the cost of operation of the storage dumps, the interest on the cost of the steamers and dumps and the royalties to the patentees of devices used.

In spite of the operative cost, the advantages of the storage dump over the present loading system are decided. The delay of carts at the

ONE OF THE DUMPING BOARDS NOW IN USE.

(Scow under nearer board is receiving garbage. Under the outer board is a Barney dumper receiving ashes, street sweepings and rubbish.)

dumps in use at present, by the shifting of scows when one is loaded, would be avoided by the storage dump, and the dust nuisance caused by the dumping of carts into the scows from a height above them of 12 or 14 feet would be largely obviated. The doing away with the steep run now in use would afford a most fortunate saving of the wear and tear on cart horses and harness. The storage dumps may be built with an ample surplus capacity, which in itself, would be an invaluable aid to the interior work of the city when boats are delayed by fog or ice, as the continuous and uninterrupted work of the carting force of the Department is well nigh indispensable.

It would seem well, then, in view of the estimates just considered, to advise for the immediate future the following course of action: A properly equipped plant for handling the ashes and sweepings transported to Riker's Island by either of the transportation systems reviewed, should be installed and put in operation at once.

The moment this is done, dumping at sea may be stopped, and the residents of Long Island's beaches freed from a nuisance which will continually increase as long as sea dumping is continued. The Board of Estimate and Apportionment has at present before it a request from this department for the granting of money for the erection of a plant which will effectively do this work.

The plant at Riker's Island may be put in operation either by the city or by contract. If put in by the city and properly operated, a yearly saving of about $65,000 may be effected over the cost of the same work if done by contract. The present small system of storage dumps, whose erection is nearly complete, and the dumping boats soon to be delivered to the city, should be carefully developed to its fullest capacity, in order to determine as exactly as possible its capability and mark the way for future improvements and plans, when work must cease at Riker's Island and other outlets be sought for the disposition of the ashes and street sweepings.

LIGHT RUBBISH.

The light rubbish collected by the carts of the Department has always been a source of difficulty in the disposal of the City's wastes. A windy day at the dumping boards scatters broadcast over the neighboring property and into the water paper and rag clippings, and all sorts of material light enough to be carried by the wind. The complaints along the Long Island shore, during the summer of 1897, were scarcely less bitter than in the preceding summer, although practically no garbage was dumped at sea after March, 1897. The casting ashore of old mattresses, boxes, barrels, etc., made the sea dumping as fruitful a source of complaint as ever.

When the mixture of ashes and light rubbish is used for land filling, the large percentage of paper and kindred rubbish makes a fill that is long in settling and is of generally poor quality, to say nothing of its bad appearance.

The commercial value of the rubbish, as received at the dumps in 1895–1896, was made the subject of special study and report by Mr. Hawthorne Hill in the report of February 3, 1896, transmitted to his Honor, the Mayor.

I wish to report here briefly upon the present condition of the work we are doing in the handling of this material in a cleanly manner, the revenue derived from its valuable parts and the reduction of the valueless or unmarketable matter to ashes, which may be disposed of in the manner I have already described.

The disposal of the rubbish, as the disposal of the garbage, de-

pended on a separate collection, so that the value of the paper, rags, etc., collected might not be greatly depreciated, as these materials are at the present dumping boards, by soiling with ashes, street dirt, etc., and that the parts of no value might be, as just stated, reduced to ash and clinker for disposal with the other waste fit for utilization in land development.

The possibilities of value and consequent revenue to be derived from this source in the future are the subjects of a special report by Mr. Hawthorne Hill.

Thus far the erection and operation of two plants for the sorting and destroying of rubbish have given us a large amount of information as to the cost and effectiveness of this branch of final disposition.

The plants constructed, one in West Fifty-third street, which was operated last year for a time, and the one in East Eighteenth street, opened in May of this year and continuously in operation since that time—are both described, as to details of construction and operation, in the report of the Master Mechanic, Mr. George L. Walker.

Practically the full possibilities of the plant in East Eighteenth street have been demonstrated only since the picking privilege at that place was let to a contractor on September 13, at the rate of $85 per week.

Since September 13, the expenses to which the Department has been put at this plant have been those for supervision, rent, repairs and interest on the cost of the plant, and the final disposition of ashes and cinders, and wastes which are both indestructible and unmarketable. The contractor paying $85 per week for the picking privilege has paid for all labor necessary in sorting and baling materials picked out and for the operation of the machinery, as well as for the removal of the ash and cinders, and the wastes that possess no value and are indestructible by fire.

From Monday, September 13, to Sunday, December 5, a period of twelve weeks, there were received from the Department of Street Cleaning "paper carts" at the yard 3,056 cartloads. The term "cartload," in speaking of these quantities, is somewhat indefinite, as the "paper cart," though of a capacity of 4⅛ cubic yards, is always, more or less, heaped with barrels and bundles of paper. Of the material received during this time 9.5 per cent. was of such a character that it possessed no marketable value and could not possibly be destroyed by the furnace. This material consisted of such articles as woven wire mattresses, old pans and kettles, etc. These were loaded on sea-going scows and deposited at sea. The future disposition of these articles, when sea dumping is stopped, can probably best be accomplished by utilizing them to form the bottom of land fillings.

The amount of ash and clinker turned out from the furnace during this same period was about 260 cubic yards or 2.3 cubic feet per "paper cartload." This means that if all the rubbish collected daily by the carts of the Department were treated in a similar manner, the average

daily output of ashes and street sweepings of 5,200 cubic yards would be increased by about 60 yards.

The articles culled and sold from the rubbish delivered at this plant were paper (7 classes with varying grades of the different classes), rags (7 classes with varying grades of each class), carpets (4 classes with varying grades), bottles (9 classes), 7 kinds of old metals, tin cans, old shoes, old rubber, hats. The operating expenses for the

BENEATH ONE OF THE OLD DUMPING BOARDS WHERE PICKERS STORED THEIR FINDINGS.

period September 13 to December 4, including fixed charges on the plant, are as follows:

a. Interest—The plant cost to build $16,000. Interest at 3½ per cent. for 12 weeks is $129.23.

b. Rent—The lot on which this plant stands costs the Department for rent $2,000 per annum. This for 12 weeks is $461.54.

c. Depreciation—In former and briefer reports I have always put the depreciation of this plant at 10 per cent. of the cost per annum. This is not too high. Ten per cent. of $16,000 is $1,600 per annum; for twelve weeks, $369.23.

d. Supervision—The Department employs at the yard a man at night in the capacity of night watchman and one in the day time as an inspector. The salaries of these men are respectively $720 and $1,200 per annum. This for twelve weeks gives an expenditure of $443.08.

e. Final Disposition—The ashes from the destructor for the period September 13 to December 4 amounted to 168 cartloads of the ordinary ash-cart size, and the wastes that were neither salable nor destructible amounted to 293 cartloads of the "paper-cart" size. In reckoning the cost of disposing of this matter it will be fair to consider in the cost of final disposition only those items which have been actually augmented by the caring for the material on the Department scows.

This cost may be fairly taken for this season of the year for the whole 461 cartloads, considered of uniform size, at 22 cents per cartload. Then the cost of final disposition is $101.44.

f. Repairs and Supplies.—For the period considered (September 13 to December 4) repairs to the plant cost $120. Supplies to engine, such as oil, waste, etc., amount to $18.

For a summary of the Department expenses in the operation of the plant we have the following:

a. Interest	$129 23
b. Rent	461 54
c. Depreciation	369 23
d. Supervision	443 00
e. Final disposition	101 44
f. Repairs and supplies	138 00
Total	$1,642 52

The Department has standing to its credit the following items:

Money paid by contractor for the privilege of picking, 12 weeks, at $85 per week	$1,020 00
Final disposition saved on 3,056 cartloads, at 22 cents	672 32
Total	$1,692 32

This gives a balance in favor of the plant of $49.80.

There has been no nuisance from the operation of the furnace, and it has been possible to keep the entire plant in a very decent condition when consideration is taken of the litter that is handled. It certainly is infinitely better in every way than the conditions prevailing beneath the present dumps of the Department.

A review of the summary of operating expenses of the plant in East Eighteenth street shows that the heaviest items of expense to be borne by the Department are those for rent and supervision. It is obvious that no larger supervisory force would be necessary for a plant of several times the capacity of this one. The furnace used in the Eighteenth street plant has been run to its full capacity. Therefore, in order to increase the profit derived from such a plant, it will be necessary to construct one whose ground rent will not exceed that of the plant in Eighteenth street, and whose capacity for assorting and destroying will very considerably exceed it. The plant and furnace of the Morse-Boulger type, whose erection and operation in East Forty-eighth street is proposed, and whose construction and operation is described in the report of the Master Mechanic, will undoubtedly show a very large increase in returns per unit of rubbish destroyed over those given by the Eighteenth street plant.

The material disposed of by the Eighteenth street plant, from September 13 to December 4, inclusive, was 5.8 per cent. of the total collection of rubbish by the Department and permit carts for this period from the entire city.

The arrangement of the carting system and the topography of the city will render it necessary to erect just so many plants of this kind as not to increase the cart haul and yet not save in the haul at the expense of rent, interest, etc., which will accompany the erection of each new plant.

A rough estimate made during the summer indicated the necessity of seven plants, each about four times the capacity of the one in Eighteenth street, and costing to operate $221,000 per year. This estimate also showed that if the same material were transported to some place outside the city where it might be handled in a single plant of sufficient capacity, it could be disposed of—including transportation charges—for $144,000, a difference in favor of transporting and handling in one plant of $77,000 per annum. These figures were for operating expenses alone. It was assumed that there would be no loss in value of the revenue-returning material in the course of transportation; but this is probably incorrect.

A careful observation and record of the operations of the plant to be erected in East Forty-eighth street ought to show very positively, after a few months' operation, which will be the better course to pursue in this respect.

I have thus far given no attention to the matter of the value of the steam power created by the burning of the unmarketable matter. In a plant like the one at Eighteenth street, and the one proposed in East Forty-eighth street, about the only thing for which the available steam power may be utilized is the production of light; and, unfortunately, the steam production is at a time of day when there is practically no demand for this commodity. A chamber for storing refuse in the plant proposed for East Forty-eighth street may prove of value in this re-

spect, in allowing the production of steam power at night and its utilization for light production.

Demands for steam power in other directions than that for lighting are, I believe, so small and variable as to forbid a consideration of them as a source of revenue in such a plant, though in special cases they might be such as to be of very material advantage. As far as the production of power is concerned, the handling of all of this material in one plant certainly offers greater possibilities than where it is handled in several small ones.

CHARLES A. MEADE,
Superintendent Final Disposition.

SPECIAL REPORTS ON WASTE DISPOSAL.

THE PRIVATE COLLECTION OF GARBAGE.

A certain amount of swill or garbage from New York hotels and restaurants is removed daily to points outside the city, under permits issued by the Health Department. Thirty years ago, according to the advocates of sanitary reform at that time, the swill-boiling establishments and accompanying piggeries were among the worst of the many public nuisances then existing in New York. In the report of the Citizens' Committee of 1865, on the sanitary condition of the city, eighteen such establishments were enumerated on the single block bounded by Sixth and Seventh avenues and Fifty-first and Fifty-second streets. The first practical result of the work of that Committee was the creation of the Metropolitan Board of Health, with jurisdiction over a district composed of the cities of New York and Brooklyn, and among the earliest ordinances passed by the Board was one prohibiting the boiling of swill within this district.

The exodus of the swill collectors was first toward Hunter's Point, on Long Island, where they established themselves upon lands which had never been cleared, forming a considerable settlement too remote from other habitations to give rise to any complaint of nuisance. In time, however, the movement of population began again to inconvenience the proprietors of piggeries, and those who have remained have had a varied experience in defending their position in the courts. They have, indeed, compromised with public sentiment so far as to substitute cattle for pigs, as less offensive to their neighbors. Now that they have been included in the Greater New York, the swill collectors expect that even the feeding of cattle by their methods will be prohibited shortly. Their business has become gradually less profitable, however, and doubtless would cease soon to exist in any event. One complaint is that their swill business has suffered from the competition of the Germans in Secaucus, in New Jersey, whose economy in living cannot be equalled in Long Island City.

While the swill-collectors were dislodged gradually from the metropolitan district, so far as the location of their piggeries was concerned, they continued to remove swill from the hotels, there being at that time, in fact, no better system to take the place of their wagons. The practice still prevailed of throwing swill from private houses, and especially from tenements, into the middle of the streets, to be trodden under foot and resolved gradually into its primary elements. It was a relief to the people of New York to be rid of the piggeries, but a

nuisance remained in the methods of the swill collectors, whose filthy carts defiled the streets and the ferry-boats. The Metropolitan Board of Health undertook to minimize this nuisance, and its efforts at regulation have been continued by the Health Department of the City of New York.

Under the Sanitary Code no private person shall engage in the transportation of swill within the city without a permit from the Health Department. There are in effect at the time of this writing (November, 1897), such permits for 38 wagons, each covering the removal of swill to a specified dock, and requiring wagons to be covered, not to leak, and to be disinfected periodically. The hours during which swill-carts can cross the ferries are limited. Each permit mentions the number of barrels of swill which its holder estimates that he will handle daily, and the figures aggregate 683 barrels. Putting the average weight per barrel at 140 pounds, which is believed to be fair, season by season, the daily volume of this business, in round numbers, is 48 tons.

The methods of conducting the swill business are the same, whether in Long Island City or in Secaucus, except that the Jerseymen, for the most part, continue to feed pigs. Their wagons leave for New York daily about 10 o'clock, and visit certain hotels and restaurants with which contracts have been made. Returning in the early morning hours, the swill is emptied into iron kettles of one or two tons capacity, in which it is cooked—rather than boiled—for twenty-four hours, or until the return of the wagons on the succeeding day. The grease which has risen to the top is then skimmed off, pressed and run into tierces for sale. The remaining contents of the kettles are fed to pigs or cattle—being mixed, if for the latter, with hay and bran or pollard. If there is any surplus, it is sold to neighboring farmers, who generally feed a few pigs. Formerly the high price of grease yielded a profit from this source alone, but at 2½ cents a pound, all that the soap makers pay now, on delivery, it is claimed that the grease product fails to pay even the cost of the coal burned. The firing is constant, day and night, seven days in the week, since the hotels insist that the service rendered them shall not be intermitted on Sundays. But the cooking is essential to fit the swill for feeding.

The last remnant of the swill business in Long Island City is confined to the quarter known locally as "Sunnyside." Only four or five swill collectors are left, and these are grouped south of Jackson avenue, some 2½ miles from the Thirty-fourth Street Ferry leading from New York. Here Patrick McIntyre, the pioneer piggery-proprietor in town, is still at work at his original location. Not far away is Edward O'Keefe, whose father followed McIntyre from West Fifty-first street, New York, years ago. Their early associates in the business are gone, the others engaged in it to-day being comparatively "new comers." The two men named are credited by their neighbors with considerable holdings of real estate, paid for from the profits of their business

in palmier days, so that they could look with equanimity upon any further suppression of cattle-feeding with swill.

Although more recent in its origin, the swill business back of Hoboken, in the scattering town of Secaucus, is conducted on a larger scale. Here are owned the greater number of the swill carts licensed by the New York Health Department. Among the holders of swill permits are Carl Schnell, Frank Eckhardt, H. Fisher, Jr., Jacob Blatz, C. Koegel, A. Hornung, J. Himsel, A. Zengel, H. Hummel and George Lausecker. Everybody here is interested in the same business, with no fear that a neighboring great city will ever absorb their out-of-the-way village, with ordinances to restrict their means of a livelihood as a nuisance. These, too, are a thrifty people, many of whom have paid for their homes with wealth gleaned from New York's wastes.

There is also to be considered the collection of garbage from some of the more important hotels and restaurants in the city by Messrs. P. White's Sons, of No. 41 Peck Slip, who have long had the contract, awarded by the Health Department, for the removal of dead animals from the streets. This garbage is handled for the purpose of extracting the grease, at Barren Island, where are located several establishments for the utilization of waste products, in which the same firm have an interest. The Messrs. White also make collections every day in the week, and while the weight varies widely, with the different seasons, the daily average during the year probably is not far from 90 tons.

HAWTHORNE HILL.

THE GARBAGE TANKAGE TRADE.

Since it is essential to the successful operation of any garbage reduction contract that a profitable market shall be found for the "tankage" produced, some considerations on the conditions of the trade in this commodity are presented herewith, based upon the statements of commercial authorities in response to a request in behalf of the Department of Street Cleaning.

Garbage tankage has distinct advantages as a raw material in the manufacture of superphosphates, possessing the requisite qualities of a "filler" required for certain grades of fertilizer, and also the property of absorbing moisture quickly, and thus being a good "dryer." A further advantage is the cheapness of the dried garbage, which induces manufacturers to use it, while at full market prices ruling for better grade materials they would not handle it. The operation of each new municipal contract for garbage disposal by any of the reduction processes naturally increases the supply of garbage tankage and tends to depress prices, as has been demonstrated of late through the material increase in the production of this material. The continued extension of garbage reduction must be looked for, however, in response to the

demands of sanitary science that the old methods of disposal of city wastes shall be abolished. Improved methods became a necessity for the City of New York, for instance, because of the menace to health from the pollution of the neighboring shores so long as the garbage was sent to sea. On the other hand, it has appeared of late that contractors have not been careful always to study the conditions of the fertilizer market, and as a result, their estimates sometimes have been too liberal as to the market value of the garbage tankage to be produced by their methods. Each new garbage reduction plant unquestionably helps to depress prices. It is evident, therefore, that a point may be reached when the market will be over-supplied with garbage tankage, rendering its sale at a price commensurate with its cost impossible.

It must not be overlooked that garbage tankage has also its disadvantages. Its low percentage of ammonia renders it absolutely unsuited for high grade fertilizers. One of the largest fertilizer manufacturers in the United States has works located on Barren Island and yet will not use any of the garbage tankage produced there in large quantities by the contractors for the disposition of the garbage from New York and Brooklyn, because he manufactures only fertilizers requiring materials richer in ammonia. Garbage tankage affords a satisfactory basis for a fertilizer for cotton lands, for which a high percentage of nitrogenous matter is not considered essential, and a considerable quantity has found use as a raw material in that direction. But here is encountered a second disadvantage, the great bulkiness of garbage tankage in respect to weight as compared with other available materials, which make transportation more expensive in many cases. Generally speaking, garbage tankage will not bear transportation for a great distance, since, with the low percentage of those elements which form the available plant food, transportation rates alone will raise the cost "per unit" of these ingredients to a higher figure than they cost in any other materials.

For the various reasons here given, the sale of garbage tankage constantly becomes more difficult, and is accomplished only by making larger and larger concessions to buyers. How much of the difficulty about prices for some time past may have been due to a generally depressed condition of business and industrial conditions it is impossible to say. A revival of general prosperity undoubtedly would improve the condition of the fertilizer trade somewhat, but not to the extent of elevating prices appreciably of a low-grade article, such as garbage tankage, produced on a constantly increasing scale.

Of the various materials used as a base for superphosphates, garbage tankage ranks after tankage from packing-houses, dried blood, fish-scrap, nitrate of soda (or sulphate of ammonia), and even cotton-seed meal. The latter contains as high as 8½ per cent. of ammonia, while garbage tankage does not exceed 3½ per cent.—an important difference in favor of the cotton-seed product. Besides, the cotton-seed meal is

abundant in close proximity to the southern fertilizer factories, and likewise near to the plantations on which the complete fertilizers are to be applied, and therefore it can be used to great advantage.

Of the garbage tankage now in the market, the highest prices are obtained for the product of the St. Louis reduction plant, for the reason that the municipal contractors there also handle in the same plant the dead animals collected in the city, with the effect of giving a higher percentage of ammonia to the resulting garbage tankage. Material from the slaughter-houses and packing-houses is also sometimes bought by the contracting firm and added to the city wastes, with a view to still further enriching the garbage tankage in ammonia. Naturally this makes the cost of the product higher than where it results merely from the reduction of the garbage, so that, while the price of St. Louis tankage is frequently higher than that from any other city, the impression prevails in the trade that the St. Louis contractors have lost money.

From interviews had with members of the fertilizer trade in New York, it appears that a fair price to quote for the St. Louis product would be from $5 to $5.50 per ton, free on board. The same quotations rule for garbage tankage from Detroit, Michigan, for the reason that it is also the product in part of dead animals collected in the streets. The New York and Philadelphia grades, while less rich in nitrogenous matters, have the advantage of being produced nearer to important centres of fertilizer manufacturing, and hence are quoted at about $4.50 to $5 per ton. For the output of the Milwaukee garbage reduction plant, $2.50 per ton is asked, while for the Cincinnati product, owing to the more favorable location of that city with regard to the fertilizer industry, $3.50 would be a fair quotation. But any one planning to engage in the production of garbage tankage to-day would be wise to figure upon even smaller returns than these figures indicate, as the market price is subject at all times to fluctuations.

It may be mentioned here that the recent decline in the price of cotton, by lessening the buying power of the planters, has had an unfavorable effect upon the market for the fertilizer materials used on cotton plantations. Another depressing factor of late has been the cutting of rail-freight rates, which by lowering the cost at which high-grade fertilizers may be laid down to the consumer has diminished the demand, for the time, for the low-grade products.

The comparatively slow movement of garbage tankage, as a new fertilizer material, is not due to any ignorance on the part of the trade in regard to it. There is not a manufacturer of fertilizers in the United States, in a position to use garbage tankage, who does not know where and at what price it may be bought. They are constantly besought to buy, by means of circulars and letters from brokers. Nor can it be said that the limited sale of garbage tankage is due to any prejudice against it as a new material. Everybody in the fertilizer business is too fully impressed with the importance of economy not to seize eagerly upon whatever may promise any lessening of cost of production. The

fact is, that the character of garbage tankage is thoroughly known; that within a limited extent it has a purpose and fills it admirably; that the "fluffiness" of this material reduces its usefulness as a "dry mixer," owing to its indisposition to combine with other ingredients, and only a limited number of manufacturers are equipped to use it. It is a fact, furthermore, that beyond certain limits, most manufacturers could not use garbage tankage, even at half its present low price. The natural tendency of all fertilizer materials seems to be downward, which fact most investors in city garbage contracts have overlooked in estimating the value per ton of garbage tankage. It goes without saying that sooner or later the losses through contracts entered into by parties so overestimating will fall upon the taxpayers of the various cities.

HAWTHORNE HILL.

STREET SWEEPINGS AS A FERTILIZER.

Within the past year an investigation was made into the character of the street sweepings, with reference to their possible value for agricultural purposes. After the adoption of the bagging system, it was suggested that, with the added convenience in handling this material, its qualities as a fertilizer might be turned to account to the City's advantage. Furthermore, it was recalled that, years before, the City had derived a revenue from the sale of some such refuse. Accordingly, the co-operation of the New York Agricultural Experiment Station at Geneva was sought and cheerfully given. Samples were selected carefully, under such circumstances as to make them representative, and two such samples were analyzed by Mr. L. L. Van Slyke, the chemist of the station. From his communication to this Department the following figures are quoted:

"Sample No. 1 contains 32.88 per cent. of moisture, 0.38 per cent. of total phosphoric acid (most of which is available), 0.37 per cent. of potash and 0.29 per cent. of nitrogen.

"The second sample contains 21.68 per cent. of water, 0.32 per cent. of phosphoric acid (mostly available), 0.31 per cent. of potash and 0.21 per cent. of nitrogen.

"In order that you may compare these figures with the composition of average well-kept mixed stable manure, I give you the following statement of composition of the latter: Phosphoric acid, 0.25 per cent.; potash, 0.50 per cent., and nitrogen, 0.50 per cent. At present prices nitrogen is worth about 13 cents a pound; phosphoric acid, 5 cents, and potash, 5 cents a pond. On this basis stable manure has an approximate fertilizing value of about $2 per ton. Sample No. 1 has a fertilizing value of about $1.50, and Sample No. 2 a value of nearly $1.20 a ton."

Under present conditions of the fertilizer trade it would not be practicable to attempt to market a material of so little value in proportion to bulk and weight. The proposition was made to the Long Island Railroad Company, who own extensive unimproved lands, that any quantity of street sweepings which they might desire to use as a dressing for such lands would be delivered to them free of charge at the City's dumps, but the company were disposed to accept the material only if delivered by the Department at the other side of the East river, and all negotiations ceased.

In 1830 the City derived an income of $19,033 from the sale of street sweepings and manure; in 1840 the figures reached $38,711; in 1850 they were only $30,898, and in 1860 they fell to $17,928. All receipts from this source ceased not many years later. But in those days the high-grade commercial fertilizers now in general use were not known and the cheaper materials had relatively a higher value than now. Besides, the neighboring farms and market gardens then approached more nearly the heart of the city than at present, admitting of a shorter haul by the farmers who bought street sweepings for use as manure.

HAWTHORNE HILL.

THE TRAFFIC IN WASTE PAPER.

Two considerations connected with the destructor system for waste materials which may have a bearing in its favor upon the net results to the City treasury are:

1. The certain recovery of a larger volume of salable articles than under the old scow-trimming system; and

2. The probable establishment of a higher standard of value for the chief products than now prevails.

There is no basis for accurate comparison under either of these headings, but certain facts connected with the working of the experimental plant in East Eighteenth street promise desirable results. First, the gleaners at the destructor-belts find better conditions for their work than existed for the scow-trimmers. The regularity possible in loading the belts prevents such congestion of the debris as sometimes, in dumping from carts into scows, interfered with the work of the scow-trimmers, causing them to overlook salable scraps. Again, much material which formerly was contaminated by garbage or ashes on the way to the scows, becomes available under the more cleanly method.

As for the financial consideration, the figures presented in this report make a favorable showing for the destructor system, as supplementing the household separation of the wastes handled by this Department. The City's revenues from the leasing of scow-trimming privileges under the former régime were based to no small extent upon the salable value of the bones and fat collected by the scow-trimmers.

The bones and fat now go to Barren Island, under the garbage-disposal contract, but it is possible that, under the destructor system, they would be more than compensated for, both by the increased collection of paper and rags, and the obtaining of higher prices for these materials. Hence the inquiry whether an adequate system of destructors, if erected by the City, might not be leased to contractors for more than the highest former receipts for scow-trimming privileges.

The most important product of the destroyer system will be "paper stock," including paper and rags, and it is with regard to paper that the greatest difference between the old and new systems may be expected. While there is an immense trade in waste paper in this city, what is known as "dump stock" has at no time formed a large percentage of it, and in recent years it has fallen off. Prices of paper stock have declined, under the competition of wood pulp, until the mills can buy clean lots for little more than the cost of cleaning such paper as could be gleaned from the masses of garbage, ashes and general wastes dumped indiscriminately into the scows. The low prices for paper of this class and the irregularity of the demand latterly led the scow-trimmers to neglect it, except when orders were in hand for certain grades for immediate shipment. Most dealers after a time declined to handle such paper, and it has been accepted at comparatively few mills. But with the incentive of orders, the collection of paper at the dumps sometimes used to attain such volume as to indicate a large possible total yield, which bids fair to be realized under a system which protects the paper from all damaging contact and gives the gleaners a chance to save every scrap, while securing a higher valuation in the market.

In a "Report on the Final Disposition of the Wastes of New York," published by this Department in 1896, an estimate prepared from the best sources then available gave 25 tons as the average weekly outturn of paper from all the dumps. Under date of July 17, 1897, a statement prepared for the Superintendent of Final Disposal in this Department indicated the collection in one week, at eight dumps, of 454 bales of paper. Based upon the average of the weights given, the total would be 75 tons. These eight dumps, by the way, yielded only half the total quantity embraced in the estimate of 1896.

The tendency shown by these figures, as well as other data bearing upon the same subject, bears out the prediction that the household separation of the garbage from other materials—in full force since the beginning of 1897—would result in a larger yield of salable paper. Mention may be made here of the weekly returns for the scow-trimming privileges for several months prior to the going into operation of the garbage-reduction plant at Barren Island, which only went as high as $1,368. During the corresponding months of 1897 the City's average weekly revenue from this source, notwithstanding that the scow-trimmers no longer collected bones and fat, averaged $800. Subsequently, *i. e.*, from August 30 to the end of 1897, the same contractor paid for the

same privileges $960 a week, while he has signed a contract, to apply from the first of the new year, at $1,225 per week. The latter rate will yield to the City two-thirds as much as the highest return in any former year, when bones and fat were included in the scow-trimming privileges, and paper of all grades sold for higher prices than now. The inference is that the present collections of paper stock at the dumps must have a substantial value. Besides, they are reported by dealers to have increased in volume, and in some cases in price, as a result of household separation, which minimizes the contamination of the paper, even where it continues to be taken to the dumps.

The estimate quoted above of 75 tons of paper per week for certain dumps is at the rate of 150 tons per week for all of them. A year ago a large buyer of paper from the dump lessees calculated that, if the demand from the mills were continuous, 90 tons of paper per week could be obtained from all the dumps, that being before the separation of garbage was begun.

At the East Eighteenth street plant, during the week June 21 to 27, the paper baled amounted to 58,473 pounds, or over 29 tons. It was culled from 236 loads of refuse, carted from 4 of the 58 sections into which the work of the Department is divided—Nos. 12, 14, 16 and 18—representing but a small percentage of the total area of the City. The dump to which all the refuse from these sections—and some others—was carted formerly was estimated in 1896 to yield only two or three tons of paper per week. An analysis of the stock thus baled serves to explain the increased yield of paper under the new system. This paper, from the starting of the plant to June 26, was graded and weighed as follows:

Grades.	Pounds.	Percentage of the Whole.
Ledger stock	11,450	5.25
Manila	28,278	13.15
Newspaper	59,867	27.35
Commons	79,231	36.25
Strawboard	39,320	18.
Total	218,146	100.

Subsequent results obtained at this plant have varied these percentages somewhat, but not enough to change the deductions from the above table which are to follow.

The paper which is still collected at the dumps is graded principally as "manila" and "news," and in the estimated collection of 454 bales in one week, already referred to, the classification was:

Grades.	Bales.	Per-centage.
Manila	300	66.
News	154	34.
Total	454	100.

Whereas, about 82 per cent. of the paper baled at the destructor is of cheaper grades than "manila," only 34 per cent. of the paper gathered at the dumps is so classed. At a crematory operated by Herbert Tate, in West Fifty-third street, in 1895 and 1896, about 167 tons of paper were baled, in two grades, of which 21 per cent. was "manila." This paper came to a great extent from stores, which may explain the larger percentage of "manila" than at East Eighteenth street, where rubbish is received from a residence district, under the new household separation system, which makes available a large bulk of newspapers. The point of these comparisons is not that the percentage of high-grade papers has been reduced, but that, under the new system, a large amount of paper otherwise useless has become commercially valuable.

Without doubt the new regulations of the Department will tend to discourage the activity of the itinerant paper collectors who have been accustomed to help themselves from waste receptacles on the sidewalks, to the extent often of violating the city ordinances by scattering litter upon the streets. When paper is no longer thus exposed, but is retained within doors for the coming of the Department carts, naturally there will be fewer private collectors, and this means fewer competitors for the paper to be culled from the sweepings of the large stores. The basements of many stores are now visited regularly by collectors, under arrangements involving a consideration from nothing to $1,000 a year or more for the paper. But in some of the largest stores, the receipts from the sales of paper are readily dispensed with in consideration of the prompt and regular removal by the Department of all the debris from the daily sweepings. For some months past, the yard in East Eighteenth street has received all the refuse from the sweepings of a Broadway store, which formerly sold for about $100 a month to a small paper collector, the privilege of culling daily from the basement. He paid at the rate of 30 cents per 100 pounds, without classification, and obtained about 16 tons of paper per month of good grades. Subsequently other large stores have begun to send their refuse to the Department yard, so that more clean wrapping papers—manila and other—are now reaching this point. These stores can afford better to throw away their paper than to maintain, as formerly, a service for the disposal of the valueless debris remaining, particularly since the decline

in the prices of paper stock. One dealer who formerly obtained considerable paper from certain stores, paying 30 cents per 100 pounds, states that he gave up this branch of his business because he found it no longer profitable. If the paper were assorted for him at the stores he could afford to handle it, but not if the culling had to be done at his own expense. Often the lots of paper which reached him contained rubbish which rendered the stock unsalable without a great deal of work in handling it.

In case the destructor system should be adopted fully, judging from recent indications, a much larger proportion of the waste paper of the city would find its way into these plants than has gone hitherto to the dumps. This would not include "book shavings," "straw clippings," etc., which are the legitimate by-products of book-binderies, paper-box factories and the like, nor the "over issues" of daily newspapers. But these classes of paper have never been "wastes" in any proper sense. Then, with better facilities and a larger scale of operations and a better grading of the stock than is now common in the trade, the old-paper business as a whole should become more profitable than now, even with wages higher than the earnings of money of the Italian paper gatherers who toil from dawn to dusk in the streets and far into the night in the obscure cellars which shelter their stock-in-trade. Under the new régime there would be opportunities, as lessees of plants, for those who are now leaders in the paper trade, and as employees for those who are working in it for wages.

In considering the prices at which paper has been sold from the Eighteenth street yard it should be understood that practically there is no standard of prices for old paper. The business is largely a matter of dickering, and prices depend largely upon the degree of anxiety of holders to unload their stocks or upon their necessities, since most of the collectors work on very little capital.

It appears that there has been a great change in recent years in the conditions of the business. The use of wood-pulp has lessened the demand for all other paper stock and has greatly reduced prices. As the profits began to decline the business drifted gradually into the hands of foreigners, who have not adhered to the old methods of the trade. For instance, the grading has been changed. Every marked decline in price has been followed by a decline in quality, until prices are fixed no longer by any standard, but by agreement between the parties to each transaction.

It is not enough that the general quality of a lot of paper should be good; uniformity and cleanliness are insisted on at the mills. A dealer who was buying from a collector a bale of "No. 2 manila" said that, judging from its general quality, he would have been willing to pay 50 cents per 100 pounds, but on account of a small percentage of "bogus" paper he could not afford to pay more than 35 cents, which was accepted. One dealer showed, as a specimen of paper stock returned from a mill as undesirable, a book stripped of its covers, made

of high-class material, but having bound up with it a few leaves of colored paper. Another sample of rejected paper stock is a book having a very small amount of ashes between the leaves. The removal of such foreign material involves trouble and expense, while, if retained in the paper, it causes defects in the manufactured product.

Besides the competition of wood pulp and the carelessness in grading paper stock, a factor in keeping prices down in the New York market has been the growth of the trade in other centres. Many mills now are located more conveniently with regard to other markets than to New York, and buy supplies accordingly. As to the market for old paper in future, the opinion entertained in the trade is that prices can hardly fall farther, without stopping the collection of stock. Nor does it appear that there can be much of an advance, even with a marked revival of general business, since the tendencies still prevail which have brought paper down from the high figures of former years. A leading member of the trade who was interviewed did not believe that enough paper could be put upon the market through the adoption of the destructor system in New York to depress prices. He had in mind at the time an estimate of 400 tons a week—equal to 41,600,000 pounds a year—as the probable outturn of such a system. In his opinion this paper would supplant that from some other sources. The trade would welcome an opportunity to buy paper of established grades, in large quantities, under such regular conditions as would result from the proposed system. Besides, the manufacture of paper is increasing constantly, leading to a greater demand for stock, though not at such a rate as to advance prices so long as wood pulp is abundant and cheap. It must be understood that some other stock must always be used in combination with wood pulp.

A member of an important house in the paper trade has kindly gone over in detail the various grades of paper baled at the Eighteenth street plant, comparing the prices quoted for corresponding grades in the paper trade journals, recent prices paid in the transactions of his house, and the prices paid for paper from the destructor plant. In regard to the trade journal quotations he said: "These published prices have little relation to the prices paid in the market. I don't know where they get their figures. Perhaps they intentionally make the figures too high, supposing this to be in the interest of the seller, assisting him to stand out for good prices." A summary of the comparison referred to follows:

I. Old Ledgers—Published price: $1.30 to $1.40 per 100 pounds.

This refers to book ledgers, stripped of their covers, with the back edges trimmed to get rid of binders' stitches and mucilage. Such paper might cost the mills, at the outside, $1.30 per 100 pounds. But what has been sold at Eighteenth street is "ledger stock," paper of a better quality than "book stock," and yet not as good as "old ledgers." It includes, for instance, such paper as insurance policies are written on. For some of this paper 90 cents has been obtained. The yield of

"ledger stock" at the destructor is small, and that of "old ledgers" almost *nil*, the value of the latter being too well known for many of them to be thrown away.

II. Manila—Published prices: No. 1, extra, 90 cents to $1; No. 1, ordinary, 70 to 80 cents; No. 2, 50 to 55 cents.

Real "manila" paper is made of "manila" rope, and for clean trimmings of this the mills might pay 1½ cents a pound. But most of our "manila" is made of wood-pulp and known as "wood manila." The real manila is known sometimes as "flour-sack paper," on account of being used for bagging flour. Nothing else will stand the pressure test of 80 pounds to the square inch to which flour bags are subjected. A dealer reports having been obliged recently to "haggle" over a lot of manila stock in order to get 40 cents a hundred, giving the buyer four months' time. His firm have taken most of the manila baled at the destructor at 35 cents, and one lot at only 32½ cents.

"There is not much middle ground with manilas," said this gentleman. "Unless the mills want the highest grades, they will take only the ordinary sorts, and are unwilling to pay much more for any lot than the lowest prices current. Mr. Tate asked me at the start about grading paper stock at the destructor, and my advice was to make but one grade of manila, since his total output of this sort is small, and the labor cost of making two or more grades would more than offset any possible gain in price. I cannot compare the manila paper he sells us with anything else in the market. We handle it as a special grade, which is becoming known favorably to some of our customers."

There is a low grade of manila stock known as "bogus." It includes certain wrapping papers that are not even wood manilas, except that dark colors must be excluded. American mills are more particular to turn out manila papers of a bright, even color, than papers that are strong. For this reason dark-colored papers will not be accepted for manila stock. The manila paper baled in Eighteenth street includes some "bogus."

III. Folded News—Published price: Over issues, 50 to 55 cents.

This grade comes from the publication offices of large dailies, being unsold copies which have not been unfolded or broken. Such stock goes to the paper mill with next to no handling. One advantage is that an entire lot may be composed of the issues of a single office and, therefore, uniform in quality. "Broken news," such as reaches Eighteenth street, is not only in a less desirable condition for mill use, but the quality is varied, the papers in a single bale coming from a great many sources. A house which has a contract to supply a certain mill with "over issues" at 42½ cents, bills due in four months, has paid 25 cents for broken news at the destructor, besides carting it away, which is estimated at 4 cents a hundred, or 29 cents. Meanwhile they have bought the same grade elsewhere at 27 cents, delivered, which they regard as cheaper than stock from the destructor at 25 cents.

IV. Commons—Published prices: Mixed papers, 30 to 40 cents; commons, 25 to 30 cents.

The first of these terms comes from England. It grew out of the mixture of colors—say the colored covers of pamphlets with the inside leaves of white paper, which would bring the price below that of white paper stock. "Commons" refers rather to a mixture of sorts, and is used at the destructor for what remains after the various other grades have been filled. This has been sold as high as 12½ cents, although dealers say that they can buy elsewhere for 10 to 12 cents, delivered.

V. Straw Clippings—Published price: 40 cents.

This refers, properly, to trimmings of cardboard, especially from paper-box factories. What is collected at the destructor is broken strawboard boxes—from dry-goods stores and the like—a different article. The price received at the destructor is 25 cents. Not long ago, being short on straw boxes, a New York house imported a quantity at a cost of 26 cents. Should the price here go above 26 cents, it might be cheaper for the trade to import this grade, and similar conditions may exist with regard to other sorts baled at the destructor.

It is hardly necessary to discuss further the subject of prices for these grades. What is of chief interest is that, while the leading houses in the trade have had an opportunity to bid on the paper at the destructor, none have offered higher figures than are now received.

At the end of the twenty-first week of actual operation of this plant—October 30, 1897—the amount of paper which had been sold and delivered was 1,169,418 pounds, while probably 16,800 pounds remained in stock. Estimating the same rate of outturn for an entire year, and figuring the sales at the most usual prices obtained to that date, the result of the paper business at the destructor would appear as follows,* the classification being based on the actual results for twenty-one weeks:

Manila	504,685 pounds,	at 35 cents	$1,766 40
News	859,405 "	25 "	2,098 51
Mixed	826,297 "	12½ "	1,032 87
Strawboard	766,913 "	25 "	1,917 28
Total	2,937,300 pounds		$6,815 06

This result is to be compared with, perhaps, 150 tons of paper per year from the same district, as collected at the dumps under the old régime, netting the dump-lessees not over $5 per ton, or $750 altogether. No reason is known why some such comparison might not hold good for the entire city, showing a like advantage in favor of the destructor system.†

Since the household separation of wastes began, and paper going to the dumps is no longer mixed with garbage, the classification of

* No account is taken here of the small amount of "ledger stock" baled at destructor, the quantity of which has been irregular.

† Since this table was prepared the quantity of paper stock handled at the destructor has been very much increased, without any necessity for enlarging the plant. But as this has been due to changes in the street cleaning sections drawn upon, and to receipts of paper from stores in the heart of the retail district, it is deemed proper to allow the figures already given to stand as repre-

"dump stock" is disappearing, and the material collected is becoming known as "city stock." It is a better class of paper, is assorted to some extent, is in better demand and at higher prices, and is collected in larger volume than formerly. This is the class of paper referred to in a preceding mention of 454 bales collected in a single week at eight dumps. The following prices have been paid lately at the dumps for this new class of material, according to the dump lessees: Manila, 25 cents per 100 pounds; folded news, 20 cents; mixed, 15 cents.

This stock is collected, to some extent, for storage. It is sometimes shipped directly to the mills by the houses receiving it from dump lessees, and sometimes sold to larger concerns in the trade, who in turn make a profit on the stock before it reaches the mills. These prices are not higher than have been paid for "dump stock" in the recent past, while they compare favorably with the prices obtained for stock at the destructor. This is due, according to one dealer, to the reputation of paper from the dumps which still adheres to any paper from this source, however handled, and time will be required for the mill owners to become satisfied that the paper now offered is preferable to that formerly supplied. He insists that the paper from the dumps to-day is "100 per cent. better" than the same grades in former years, but the grading needs to be improved before the best results in price can be hoped for. Besides, he says that the best "city stock" has an objectionable odor which suggests the old "dump stock."

The last mentioned dealer states that early in the history of the "dump stock" trade he paid as high as 1¼ cents a pound for manila, and correspondingly high prices for other grades. Later ¾ cent was a standard price for manila from this source, after which the price declined gradually to the figures paid to-day. The books of another house show the payment of 50 cents a hundred for "No. 2 manila" from the dumps as recently as 1893. There is no hope, therefore, of an advance in prices for paper stock equal to those of the earlier régime. The most that can be expected is a better price for carefully graded lots than is now paid for paper from the dumps, with an additional slight advance in case there should be an improvement in general business.

Doubtless it would be desirable if the paper mills would contract to take the baled paper from the destructors at fixed prices. But the opinion is general in the trade that this is unlikely to happen. The paper mills have an excess of capacity, and their operation is not continuous. Again, a manufacturer having an opportunity to buy on advantageous terms, may acquire enough stock to make further purchases unnecessary for a long period. Hence they prefer not to contract for stock, but to go into the open market according to their needs. At the same time, the tendency of dealers in paper stock is to become

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sentative of average conditions. The Superintendent of Final Disposition estimates that the capacity of the Eighteenth-street plant amounts to six per cent. of what would be required to extend the system throughout the City of New York. On this basis, the results given in the table would represent from four and one-half to five per cent. of the total output for the city under such a system.

commission merchants merely. Instead of buying largely and warehousing the stock until sales can be made at a profit, they are more apt to await orders from the mills, which they fill by sending out to paper collectors, charging an agreed upon commission. No paper stock is imported for storage, but only to fill orders, just as it has not been customary to collect paper at the garbage dumps except as wanted at the mills.

Old paper of any grade is of small value in proportion to bulk, is perishable, is in irregular demand, involves a heavy expense for storage, and at no stage does it afford a liberal margin of profit. All of this is to be considered before the Department of Street Cleaning becomes engaged in the paper trade, together with the fact that the paper mills buy mostly on long time, while so many failures have occurred in recent years as to render the risk from this source something to be figured on in every large transaction.

Part of what is written above applies to rags no less than to paper. Rags can be handled under better conditions at the destructor than formerly at the dumps and marketed to a better advantage. But the same increase in the outturn as in the case of paper can hardly be expected, since rags, on account of their greater strength, could always be collected from the dumps, no matter how badly soiled. It may be worth while, however, to give an estimate of the collection of rags at the destructor for one year, based upon the actual sales from there during twenty-one weeks of actual operation. An estimate of the money value is not attempted on account of the varying prices during the twenty-one weeks under review. The rate of prices paid is given, however:

Classification.	Estimate for One Year. Pounds.		Prices Paid, June to October, Per 100 Pounds.
Wool	11,898		$6 25 to $7 25
White	15,080		1 75
Black	157,125		15 to 23
Mixed	292,983		75 to 80
Carpets	145,934	Wool	3 00 to 4 25
		Soft back	75 to 1 00
		Hard back	22 to 26
		Linsey	25 to 65
Twine and bagging	65,397	Twine	36 to 50
		Bagging	28
Total	688,417		

The market for rags, and particularly for paper stock, is likewise in a depressed condition, and an increasing amount of waste of this class may be expected to reach the carts of the Street Cleaning Department in future.

SUMMARY.

I. More paper can be collected by the new method than under the scow-trimming system. In East Eighteenth street, in one week, 29 tons were baled, the product of 4 out of the 58 street cleaning sections. The estimated average weekly product of all the dumps two years ago did not exceed 25 tons.

II. The increase results from (1) better facilities for collecting paper; (2) the cleaner condition of the paper under the new system of separation; and (3) the transfer to the Department system of paper waste formerly handled privately—especially from large stores.

III. The average price obtained for the paper from the destructor is 23 cents per 100 pounds, or $4.60 per ton. This is to be compared with the old price for dump stock. The present output from the dumps —known in the trade as "city stock"—brings better prices, but not equal to the average obtained at the destructor.

IV. The new method seems likely to lessen the number of private paper collectors, and hence to lessen the competition for the paper swept from stores, which in time will remove one inducement to merchants to withhold paper from the Department carts. Some large stores already prefer that the Department shall remove all their debris, including paper. Without doubt, after the introduction of the destructor system a greatly increased proportion of the waste paper in the city will come within the scope of the Department's work.

V. These considerations apply more or less to rags, and particularly to those classed as "paper stock."

HAWTHORNE HILL.

THE FUEL VALUE OF CITY ASHES.

During the last year's study of the possibilities of the "utilization of clean ashes in the City of New York," it was learned that of the 1,500,000 cubic yards of ashes cared for annually by the Department of Street Cleaning, a very large proportion would be gladly received by the various building interests for use in fire-proof buildings, for the foundations of cellars, sidewalks, yard concrete, etc., at no expense to the City except that of collection from the houses. A brief review also was given of the various efforts that had been made to utilize ashes in the manufacture of brick and other building material.

The refuse of any coal fire, called ashes, consists of fine ash, clinker, slate, etc., and coal partly coked, in varying proportions according to the kind of coal, the kind of furnace, and the kind of fireman.

The investigations of last spring had reference to fine ash, clinker and slate only, and the study did not include any consideration of the fuel value of the partly coked coal nor any method of utilizing it. The latter subject has been the unsuccessful study of so many people, in so many cities, that it was considered inadvisable to discuss it in the brief time then devoted to the consideration of the best means of utilization of the ashes.

During the months that have succeeded, however, I have studied the fuel value of ashes of different parts of the city and under different conditions, and have endeavored to learn both the percentage of available coal and the heating value of this coal per pound.

GENERAL OBSERVATIONS.

The ashes of the City may be roughly divided into four parts: (1) that which comes from the furnaces and stoves of individual houses managed by others than those who pay for the coal; (2) that which comes from kitchen ranges of flats; (3) the stove ashes from tenement-houses; (4) the steam ashes from hotels, theatres, office buildings, factories, etc.

In ashes of the first class coal may be found in some quantity, because economy is not considered essential and because the character of the grates and the manner of operating the fires both conduce to the slipping away, unnoticed, of much good fuel. In ashes from flats may be found considerable coal, not so much from want of economy as because the lack of space in the kitchen precludes the possibility of sifting and saving coal at the expense of the dust produced thereby. In the ashes from tenement-houses, where little fuel is burnt and scarcely anything is wasted, small heating value may be expected. In steam ashes, left over from large fires which receive the constant attention of firemen more or less skilled, one may expect, and there is found, both a smaller percentage of ashes and a smaller percentage of coal.

In other days, when the ash-pan was dumped into the larger can which already contained garbage, waste-paper, bottles, cans and rubbish of every description, little notice was taken of the refuse coal; but now, since ashes are kept separate and any one may see the numerous pieces of coal, it is noticeable that in all parts of the city much more attention is given to the subject by the householder, and that everywhere persons who never before sifted their ashes now regularly save the coal. It is probable, therefore, that as months go by the percentage of waste coal in the ashes will gradually decrease.

It cannot be long, however, before the decrease must cease, because the lack of room in the majority of homes in this city, and the dust necessarily produced, will always be operative as reasons against much sifting. Furthermore, the time required each morning is considerable, and when one remembers that the total stove refuse seldom exceeds 20 per cent. of the weight of the original coal burnt, and that less than

half of this is available as fuel, it is readily seen that under the worst conditions the amount of coal thrown away is less than ten per cent. of the weight originally put on the fire. In flats, for instance, perhaps an average of two pounds of coal might, by careful picking, be recovered daily from the kitchen stove, and if this recovered coal is assumed to be worth five dollars per ton, it follows that four pounds are worth one cent, and that the daily recovery from the kitchen ashes is worth one-half cent. In ordinary cases this is small remuneration for the time, the resultant dust and the abraded fingers.

It is evident that the recovery of this coal can be a paying operation only when performed on a large scale, in proper buildings, by persons suitably clothed and probably aided by mechanical means of separation. In all my measurements, I have first separated the fine ashes by means of a screen, and afterwards separated the coal from the clinkers, slate, etc., by hand-picking. The latter operation is, of course, very tedious, and, under the best conditions, expensive. It is doubtful whether the operation could ever be made to pay, even on a large scale, by hand-picking.

AMOUNT OF COAL IN CITY ASHES.

The ashes of large house furnaces have shown on the average, 45 per cent. by weight of fine ash; 15 per cent. of clinker, slate, etc.; 40 per cent. of available coal.

The ashes from flats have shown on an average 45 per cent. of fine ash; 20 per cent. of clinker, slate and stones; 35 per cent. of coal.

Egg and nut coal ashes from factory fires have shown 45 per cent. of fine ash; 30 per cent. of clinker, slate, etc.; 25 per cent. of coal.

Ashes from pea coal from a boiler have shown 40 per cent. fine ash; 40 per cent. clinker, etc.; 20 per cent. coal.

These figures are derived from examinations of about a cubic yard of ashes in each case, and while of course they must not be allowed too much weight since they are derived from such small quantities, they are, I think, fairly representative of the conditions existing in the city during the past few months. Frequent observation of the appearance of carts and cans loaded with ashes has made it possible to select those of about average fuel value.

I am not aware to what extent the ordinary ash-can is picked over after it reaches the street, but I have found no can or cart which contains less than 20 per cent. by weight of coal, and I think that this amount may be taken as a safe estimate of the average percentage of available coal to be found in the city ashes at the dumping board.

It may be noted incidentally that the proportions of fine ash, clinker and coal, given above by weight, hold very nearly true as proportions by volume.

CHARACTERISTICS OF WASTE COAL.

When it is remembered that coal received in houses is frequently not well sized, it is easy to account for the fact that the smaller coal

recovered shows little effect of the fire, because it has fallen through the grate unburnt, while, on the other hand, most of the larger coal recovered shows some coking action.

It is a matter of common knowledge that this coal is easily ignited and very cleanly in fire-making because of its freedom from coal dust, and it has often been noted that very little clinker and slate appear in its ash, due, of course, to the fact that all such matter which, covered with black dust, originally was indistinguishable from coal, is sure to have been discarded in the hand-picking.

Waste coal differs from fresh coal principally in containing less gas, and while it therefore contains less heating power, the absence of the gas makes the rate of combustion much more uniform and the fire more easily controlled in furnaces and stoves. A new supply of fresh coal added to the fire always emits a large amount of gas which requires for a time an enormous addition to the supply of air. Lacking this, smoke is produced and the gas escapes up the chimney unburned and wasted. This additional and temporary supply of air requires the supervision of an attendant, while a coke fire may be renewed and left to itself. Further, since the only use of air in a fire is to supply oxygen, and since oxygen constitutes only one-fifth of the weight of air, the remaining four-fifths is a positive detriment in that it enters the fire cold and leaves it hot, and therefore carries up the chimney a large amount of heat. With different fuels this amount is nearly proportionate to the quantity of heat generated, and the increase and decrease of quantity of air necessary would be of no consequence could it be known and arranged for in advance. It seldom is, however, and a varying quality of fuel almost always means wasted heat from having too little air or too much.

HEATING POWER OF WASTE COAL.

To learn the heating power of this waste coal, I devised a small boiler on the order of a Rumford Calorimeter and made measurements with new coal of the same kind as the original of my recovered coal, and also with the recovered coal. The tests were continued for some time and the results represent the average heating power of the coal taken from eleven different ash-can sources.

The water capacity of my boiler was about two gallons, the grate area about .25 square feet, the total exterior radiating surface about 18 square feet. A cold water feed-pipe near the bottom supplied measured quantities of water at 42 degrees Fahrenheit. All evaporation was at the pressure of the atmosphere and at about 212 degrees Fahrenheit. Sufficient provision was made against priming, and care was exercised in the draught. I was able to burn about 2 pounds waste coal per hour, and about 1.5 pounds new coal. The temperature of the room was about 60 degrees Fahrenheit, the average of the outside radiating surface 160 degrees Fahrenheit, with new coal, and 150 degrees Fahren-

heit with waste coal, and the flue gases about 220 degrees Fahrenheit in each case.

With new coal I evaporated an average of 7.5 pounds cold water per pound fuel, and with waste coal an average of 5.5 pounds cold water per pound fuel. This is equivalent to 8⅞ and 6½ pounds respectively, of water converted into steam from and at 212 degrees Fahrenheit, which is the usual manner of stating the evaporative power of fuels.

To find the efficiency of my boiler and thus get the total amount of heat produced in each case, I calculated the heat lost by radiation, by convection, and by the flue gases. Elaborate investigations by Dulong and by Peclet have determined the heat lost by radiation from the exterior surface of such apparatus as mine at .900 English heat units per hour per square foot radiating surface per Fahrenheit degree of difference of temperature between the radiating surface and surrounding objects.

The heat lost by convection currents under such conditions is .617 English units per hour per square feet of vertical exposed surface per degree difference in temperature between this surface and the incident air.

Heat lost by the chimney gases is that carried off by the air admitted for combustion and is measured by the product of the weight of the air used, the specific heat of air, and the change in temperature.

From data supplied above, the computations for these quantities are as follows for the new coal:

Heat absorbed by water, 7.5 by (170 plus 966).....	8,520	E. H. U.
Heat lost in radiation, .900 by ⅔ by 18 by 100.....	1,080	"
Heat lost in convection, .617 by ⅔ by 18 by 100.....	740	"
Heat lost in flue gases, 300 by .0761 by .238 by 160....	864	"
Total heat given out by 1 pound new coal....	11,204	"

And as follows for the waste coal:

Heat absorbed by water, 5.5 by (170 plus 966).....	6,248	E. H. U.
Heat lost in radiation, .900 by ½ by 18 by 90.....	729	"
Heat lost in convection, .617 by ½ by 18 by 90.....	499	"
Heat lost in flue gases, 250 by .0761 by .238 by 160....	720	"
Total heat given out by 1 pound waste coal..	8,196	"

There is some doubt in reference to the amount of air used for combustion. I endeavored to furnish enough for a good draught without chilling the fire, and believe that I did so. At the same time, the rate of combustion was low, and I am certain there was very little free oxygen in the flue gases. It is possible, therefore, that my estimate of

300 cubic feet and 250 cubic feet per pound of new coal and of waste coal, respectively, is too high.

At the same time the totals of 11,200 and 8,200 heat units represent with considerable accuracy the heating power of the two classes of coal; the little boiler was very efficient, and 7.5 pounds and 5.5 pounds of cold water, or 8.9 and 6.5 pounds of hot water, respectively, may be taken as the available evaporation effect of these two coals. The new coal was poor, because it furnished 9 per cent. of fine ash and an additional 9 per cent. of stone and slate.

SUMMARY.

The amount of waste coal in ashes examined varied from 20 per cent. to 40 per cent. by weight and averaged about 30 per cent. Including tenement-house ash it would probably average 20 per cent. of coal at the dumping board. This is about 250 pounds per cubic yard, or 125,000 tons per 1,000,000 cubic yards of ashes, which is less than the city's annual output.

The value of this recovered coal as compared with ordinary new coal may be expressed as 8,000 heat units against 11,000 heat units, or 73 per cent.; 5½ pounds cold water evaporated against 7½ pounds, or 73 per cent.; 6½ pounds water evaporated from 212 F. against 8⅞ pounds, or 73 per cent.; $4 per ton delivered against $5.50, or 73 per cent.

To this report I hope to subjoin another, of averages made on a much larger scale, as soon as I am able to separate coal from clinker at a sufficiently rapid rate.

C. HERSCHEL KOYL.

UTILIZATION OF FINE HOUSE-ASH IN BUILDING.

A portion of the study of the Department during the past two and one-half years in regard to the proper disposal of city wastes has been a continuous effort to find some method of utilizing ashes better than the methods at present in use.

The ordinary waste of stoves and furnaces consists of partly burned coal, clinker and stone, and fine ash.

In a previous report I have discussed the fuel value of the coal contained in the city's ash-cans and have found it sufficient to pay for separation if conducted on a large scale and by machine methods.

The hard clinker, if separated, is known to be valuable for use in concrete.

There remains only the fine ash, which amounts to nearly half the city's total stove and furnace refuse, or about 600,000 cubic yards annually, and is the portion which has appeared most difficult of disposal in any plan heretofore proposed for utilization within the city limits.

In a report to the Department under date June 15, 1896, I said that,

In the opinion of many consumers of ashes in large quantity, it would be feasible to use the city's household ash, if free from other substances, in filling under sidewalks and cellars to the extent of about 230,000 cubic yards annually, and in the construction of fire-proof floors and fire-proof partitions to the possible amount of 600,000 cubic yards annually; and if no superior plan is found, this still remains a more economical method than that of using them for filling outside the city limits.

The same report discussed briefly the results of some attempts to utilize the sifted fine ash in the manufacture of mortar, cement and artificial stone; and while none of the specimens of these substances which I had been able to examine fulfilled all the conditions necessary to success in building work, the report contained notes of hopeful signs and said: "It is possible that the manufacture of ash into brick and concrete may become at an early date a considerable industry. It would be the perfection of 'waste' utilization to build dwelling-houses in June from the dwelling-house ash of May. Attention has been concentrated upon the industrial uses of ash—which are considerable, and the industrial possibilities—which are greater."

I have now to report briefly upon a method for the utilization of fine house ash lately brought to the attention of the Department by Mr. Joseph A. Shinn, of Pittsburg, Pa.

Mr. Shinn says that in conducting a series of experiments to learn the best method of preparing furnace slag for the manufacture of mortar and cement, he discovered that fine domestic anthracite ash has valuable qualities for making mortar. He found that when nine parts of such ash are intimately mixed with one part of fresh lime and properly wet with water, there is formed a mortar much superior, for building purposes, to ordinary lime-sand mortar, in that its tensile strength, its resistance to crushing and its resistance to fire and water are greater while its specific gravity is much less.

Mr. Shinn has submitted samples of his new ash mortar about thirty days old, to which I have applied some of the ordinary tests of lime-sand mortar, with which alone Mr. Shinn desires the new material to be compared. I have found the tensile strength to be about 65 pounds per square inch, while that of ordinary lime-sand mortar is perhaps 15 pounds per square inch; the crushing strength to be in some cases 1,000 pounds per square inch, that of ordinary mortar of same age being 150 pounds; the resistance to fire and water greater than that of ordinary mortar of the same age. I state the results thus briefly and in general terms because I find a large variation in the strength and other qualities of different samples, some running for instance in tensile strength as high as 140 pounds per square inch; some resisting the action of water for only a few hours, others equally new for more than a week; and demonstrating without doubt that when the ash mortar is properly made it has great strength and enduring qualities, but that much remains to be learned of its proper method of manufacture. The

samples made by myself under Mr. Shinn's directions are not of sufficient age to make the results of testing them of any value. Mr. Shinn insists that only by the most intimate machine-mixing are the best results accomplished.

While it is too early to state the strength and other qualities of this new material with the exactness necessary for architects and builders, the indications of its value are so strong, and the assurance of its cheapness so great, that I have thought it wise to learn in a preliminary way the possibility of thus introducing our fine house ash as a substitute for sand in the manufacture of mortar, on a scale commensurate with the City's annual output, which, as stated above, is approximately 600,000 cubic yards.

The points to be considered in the introduction of this ash mortar are:

1. Those incident to the introduction of any new material;

2. The necessity of machine-mixing, disturbing long established commercial and labor customs;

3. The present building law which provides that "mortar shall be made of clean, sharp sand."

In regard to the first point, it is the general opinion that if the new mortar proves under the tests of Engineers and Department Inspectors to have greater strength and enduring qualities than lime-sand mortar, it will be welcomed as a substitute by architects, and if it can be furnished at a less price than the other mortar it will be welcomed by builders.

Regarding the second point, it appears that in the lower part of the city, in the construction of large buildings, cement mortar alone is used, and that since the cement is of necessity unbarreled on the ground, machine mixing is out of the question. But there is much lime mortar used for plastering, and in the upper part of the city, where it is also used extensively for building, machine-made lime-sand mortar is popular and probably forms one-half the total. It thus appears that there is a large field almost waiting for the new material if its use is permitted by law.

In regard to this third point, it is the general impression that if the new mortar should prove itself at the same time better and cheaper, the present law could undoubtedly be amended to meet the improved conditions.

From present indications I see no reason to doubt the early and extended use of fine house ash for various building purposes, and the realization of the expressed hope of the Department that "clean house ash may become an article of commerce."

C. HERSCHEL KOYL.

FACTORS IN THE COST OF STREET CLEANING.

NEW YORK, June 20, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—I have the honor to submit herewith a report upon the principal factors which make up the cost of street cleaning in the City of New York, their distribution throughout the city and the percentage effect of each upon the total cost.

The term "street cleaning," as here used, applies only to the work of the sweepers and has no reference to the cost of horses, drivers or carts to remove the sweepings, nor to any other of the expenses of the Department.*

Last autumn a series of sweeping tests was made to determine the areas of asphalt, granite and Belgian pavements, respectively, which could be kept clean by one man, and the foremen were instructed to report in each case the condition of the pavement and the amount of traffic. But it was found that the differences on each class of pavement were not all to be accounted for by the dissimilarity in condition and in amount of traffic, and the present report has grown out of the desire to learn all the causes of variation.

The information has been gained through a block-by-block measurement of the area of paved streets cleaned by the Department—the measurements having been made during the winter by the section foremen, under the supervision of the District Superintendents; a statement for each block of (1) its kind of pavement—asphalt, granite, Belgian or other; (2) the condition of the pavement—good, fair or bad; (3) the amount of traffic—light, medium or heavy; (4) the amount of car track, if any—single, double, triple or quadruple; (5) the kind of rail—flat, grooved, T or steam T; (6) the amount of sanding of the track—little or much; (7) the amount of street sprinkling—whether it is sprinkling or flooding the street with so much water as to make slush; (8) the presence or absence of elevated railroad pillars and overhead structure; (9) the character of the population; (10) the number of schools; (11) the presence of market-stores, or (12) push-carts; (13) the vicinity of unpaved streets.

There are other conditions which affect the cost of cleaning, but nearly all of them are either temporary—such as building operations, or under the control of the District Superintendent—such as the energy

* Broadway, south from Fourteenth street, is not swept by the City force; and is not included in the discussion nor in the summary.

and judgment of the sweeper, or under the general control of the Department—such as the quality of brooms, etc. The thirteen items above mentioned were considered to be beyond the control of the Department, and, with the exception of the schools and street sprinkling, beyond its influence.

Having selected these factors, in consultation with the superintendents, as having the most important bearing upon the subject in hand, and the measurements above mentioned having been made, there was prepared a tabulated statement for each district, which statements form the series of tables No. 1 of this report. It is to be noted concerning these tables that the figures in some columns, such as condition of pavement, amount of traffic and character of population, are statements of opinion rather than results of measurement, and that some allowance must be made for the "personal equation," since what is considered good condition of pavement or good character of population by one man might by another be considered, in either case, only fair. It is believed, however, that with few exceptions the statements may be taken as having nearly the same relative value.

The next step was to learn the influence of each of these factors upon the cost of cleaning. This has been accomplished as well as possible—at least a first approximation has been made—by a series of discussions with the district superintendents, supplemented by numerous tours of observation in various parts of the city, at various times of day and night during the past few months. Each superintendent was requested to state his opinion upon each point, formed from his months or years of daily observation of the work upon the streets, and each entered with spirit and interest into the plan and gladly gave his best aid and information.

Table No. 2 gives the record of these opinions, with the averages. It was a question whether the average figures should be used for further work or whether it would be better to apply the ratios of each superintendent to the statements of the condition of pavements, amount of traffic, character of population, etc., given by him for his district, since it was certain that his idea of the influence of, for instance, heavy traffic, would be closely related to his idea of the exact meaning of the term heavy traffic. I concluded, however, that fewer errors would be introduced by using a constant ratio for all the districts, than a different one for each, and the figures of the series of tables No. 3 are so derived.

In preparing table No. 2, each ratio was determined as an independent factor, without reference to other conditions and without knowledge of another man's opinion. A question was, "Supposing the difficulty of cleaning good asphalt pavement to be represented by 100, what is the difficulty of cleaning good granite pavement or good Belgian pavement, all other conditions being the same?" The replies varied for granite from 125 to 200, and for Belgian from 125 to 220; representing in each case the experience of one man perhaps in one dis-

trict, perhaps in two or more. The longer the experience of the man, the more likely was his opinion to be accurate for his district; the wider his experience, the more likely was his opinion to represent an average for the city. Many superintendents desired not to be quoted as expressing an opinion of value for the city, based only upon experience in one district, and frequently without time for mature deliberation upon the subject, so that I must assume the full responsibility for introducing, to elucidate the report, the statements of opinion which were given only for my personal guidance, frequently on brief consideration and with many expressions of diffidence. I must also be responsible for such difference in interpretation of terms as may exist.

With table No. 2 complete, the average figures from it were used to multiply into the figures of table No. 1, and thus derive table No. 3. It is evident from reference to the table that by the method here adopted we obtain for each kind of pavement, by sections, all the principal difficulties expressed in terms of square yards of asphalt pavement, in good condition, with light traffic, with no car-track, with good population, and with all other conditions favorable. This gives an absolutely uniform method of statement and enables us to sum up the difficulties in terms easily understood. For example, if granite is more difficult to sweep than asphalt by 50 per cent., it is evident that to obtain a statement of all the difficulties of cleaning granite, we must begin by adding in column 2 of table No. 3, 50 per cent. of the granite area. Then, if the condition of the granite is bad, there is to be added in column 3 of table No. 3, 40 per cent. more to represent this, and thus there are expressed in succession the equivalents in square yards of the various difficulties existent on the granite of that section.

The column in table No. 3, headed "Equivalent Total," is the sum of all these items, and expresses the total difficulties of each kind of pavement in each section, in terms of square yards of our ideal pavement.

To derive the next column, "Sweepers Necessary," it remained to learn how many square yards of pavement under ideal conditions could be kept clean by one man. Observation of the city on Sunday showed that when the traffic is light and the character of population good, a street may be kept clean by one thorough sweeping and a little picking up daily. And observation in selected portions of the city demonstrated that where asphalt pavement is good, with other conditions as specified, a sweeper may cover with one thorough sweeping and a picking up about 20,000 square yards daily. I have, therefore, adopted this as the amount of our standard pavement which can be kept clean by one man, and the "Equivalent Total" divided by this number gives in each case the number of sweepers necessary.

For the sake of comparison there is added a column showing the number of sweepers employed, and, derived from these, two other columns showing the amounts of pavement of each kind that ought to be and that are kept clean by one man in each section.

The mass of details has been so great that only tabulated statements could show the results in readable form, and the tables are more easily understood than an explanation of them; but exactness of knowledge has grown with the progress of the work, and I regard this report as preliminary to a more exhaustive treatment of the subject, based upon longer continued observation, measurements more accurately made, and ratios of influence more definitely determined. The difficulty of making these first conclusions rigidly exact may be judged from the fact that one item, now considered to have marked influence upon the cost of sweeping, passed unnoticed the consideration of all the superintendents and myself, and has been brought out by a thoughtful foreman only within a short time and too late for use in this report.

Notwithstanding, however, its preliminary character, I have some proofs of the accuracy and value of the conclusions reached by the table of equivalents. In the case of one district the number and arrangement of sweepers employed tallied quite closely with the figures for sweepers necessary, except that in one section there were six sweepers on granite and twelve on Belgian, while the table of difficulties showed that there should be 12.2 for granite and 6.3 for Belgian. Upon sending to the superintendent his original report with a request for reconsideration, he returned it with the twelve and six transposed, and a note saying that there had been a mistake in copying. In another case, a serious error in the amount of street car track was found in the same way; and in still another, a mistake in the pavement area. Without the table of equivalents as a guide, a sweeper might have any amount from 2,000 to 20,000 square yards of pavement to keep clean, and no one could tell without personal observation whether he was overworked or not, but with the table of difficulty-equivalents at hand the number of men necessary in any section and the amount of work per man are determined within narrow limits. I am well satisfied with the general accuracy of the report.

The figures in table No. 1, for cost of sweeping 1,000 square yards per week, were deduced from the number of sweepers employed, weekly wages being $13.77 each.

Following tables Nos. 1 and 3 are summaries by districts, and last of all a summary for the city, which shows also the number of sweepers made necessary by each of the difficulty-items discussed. It is interesting to note how the total requirement of 1,638 sweepers is made up.

Were the pavement all asphalt and the population all neat in their habits, were there only light traffic and no street-car track, were there no push-carts and no market-stores, were every consideration ideal, there would still be required for sweeping the streets a force of 466 men.

The density and character of the population in a few parts of the city make necessary 388 more, so that about one-quarter of the whole

force is used in the extra sweeping and resweeping of the crowded sections of the city, in some streets as often as seven times daily.

The great amount of traffic calls for 323 additional men to clean up after it, and probably should be debited with the 29 extra men of the First District, making a total of 352 men, due to density of traffic alone. The added difficulty introduced by granite and Belgian pavement requires 200 men more; that by street-car tracks, 86 men; the bad condition of the pavement in some streets, 62 men; the vicinity of unpaved streets, 36.

KINDS OF PAVEMENT.

There were in the city, at the time the measurements were made, about 1,920,428 square yards of asphalt pavement, 5,197,339 square yards of granite, 2,152,319 square yards of Belgian, and 55,458 square yards of other pavement—brick, wood and cobble.

For purposes of cleaning, the city, with its 9,325,544 square yards of paved streets, is divided into 11 districts, and these districts into 5 or 6 sections each, so that there are all together 63 sections. The section, with an average area of nearly 150,000 square yards, being the smallest official subdivision, has been used in this report as the unit of tabulation.

A well laid asphalt pavement is, in dry weather, easy to clean because being smooth it lends itself to the operations of a man with a scraper, so that the mass of the dirt may be gathered with considerable rapidity and there is left for the tedious labor of the hand broom only the cleaning of corners and edges and the final dressing of the street.

Granite pavement, on the other hand, being composed of distinct blocks which are laid in rows lengthwise across the street, furnishes a series of furrows between the rows of blocks, into which the loose dirt of the street falls and whence it must be cleaned by the broom. No scraper can be used to advantage on a granite street, and a thorough sweeping is absolutely necessary. This means more time occupied on each square yard, and more energy expended by the sweeper than is the case with asphalt.

Belgian pavement is also composed of blocks set side by side in the street like granite, but Belgian blocks are smaller and present more furrows per square yard, and are not so well proportioned for stability as are the granite blocks in common use, so that the surface of such a pavement is nearly always uneven and the term "good condition" for Belgian means less than it does for granite. Still, Belgian blocks wear smooth with use while granite does not, and the general opinion is that Belgian pavement is only slightly more difficult to sweep than granite.

Brick pavement appears to remain in good condition after long and heavy use, and is not difficult to clean. Of wood there is only one

block in the city.* Cobble presents the extreme difficulty to the Department.

The average of all the opinions gathered from the superintendents is that the difficulties of sweeping are—asphalt, 100; granite, 150; Belgian, 160; brick, 100; wood, 100, and cobble, 400, respectively.

It is distinctly stated by them that these figures represent not exactly the difficulty of keeping these respective pavements in equally cleanly condition, but rather the best approximation they can make to the amount of work expended upon them under existing conditions. They say, for instance, that the asphalt of the city is kept almost absolutely clean, because it is so smooth and so uniform in color that a small particle of dirt is not only conspicuous, but easily cleaned, while the crevices of a granite or Belgian street hide dust and fine dirt which nobody sees and which is infrequently dug out. I have used the figures given above in my computations, but it is the opinion of the superintendents that to keep the pavements equally clean, the figures would be about as 100, 200 and 220.

CONDITION OF PAVEMENT.

Evenness of pavement surface affects the cost of cleaning, but not equally with different kinds of pavement. A depression on asphalt, where a scraper is used, is of more consequence than a depression on granite or Belgian where only the hand broom is used. The figures given are intended, therefore, rather as a general average than as strictly applicable to any one kind of pavement. The superintendents place the ratios of difficulty for conditions which I have denominated good, fair and bad, as 100, 120, 140, respectively. The variation of the variation I have left for future study.

TRAFFIC.

The amount of traffic affects the cost of sweeping for four reasons: (1) because of the amount of horse droppings; (2) because of the dirt of one kind and another which comes from the wagons, dust ground off the pavement, etc.; (3) because the passage of horses and teams effects a solid packing, into the crevices, of the dirt upon which they tread; (4) because of the difficulty of giving close attention to his work when the sweeper must devote a considerable part of his time to dodging horses and vehicles. The figures for dense traffic apply to streets in which the traffic is so congested or so swift as to interfere with the sweeper's work.

From observations upon selected streets, made by Mr. Hawthorne Hill, I learn that anything below 25 vehicles per hour on a 30-foot street, or 50 per hour on a 60-foot street, may be considered light traffic; between 25 and 100 vehicles per hour on a 30-foot street, or 50 to 200 on a 60-foot street, may be considered medium traffic; from 100 to 150

* Very smooth Karri wood on concrete.

on a 30-foot street, or 200 to 300 on a 60-foot street, heavy traffic; 150 to 300 on a 30-foot street, or 300 to 600 on a 60-foot street, dense traffic.

The figures given for the four conditions—light, medium, heavy and dense traffic, are 100, 140, 180, 250, respectively.

STREET-CAR TRACK.

The difficulties introduced by street-car rails are due to the depression of street surface along the rail, the condition of pavement between rails, and the frequent sanding of the track. The ratios given by the superintendents represent the added difficulty of sweeping a 30-foot street with a single car track. All the reductions on table No. 3 are based upon these ratios.

ASSOCIATION SPRINKLING.

Association sprinkling frequently has been the cause of complaint by the officers of the Department because of the entirely unnecessary amount of water with which some streets have been flooded by careless or wilful drivers. But of late much improvement has been noticed, due to the action of Association officers, based upon complaints made by the Department of Street Cleaning.

ELEVATED RAILROAD.

The pillars of the elevated railroad are frequently an obstacle to the continuous operation of the street sweeper, and it is noticed that after every rain the sticky condition of the pavement shaded by the overhead structure continues much longer than on streets exposed to the action of sun and wind. Continued observations incline me to the belief that the effect of this item has been underestimated.

CHARACTER OF THE POPULATION.

No other cause contributes so much to the expense of the Department in the matter of sweeping as the action of careless and thoughtless persons in making the public streets the receptacle of all kinds of rubbish of which they wish to be rid, and which a little consideration would induce them to deposit in some can or pail which might be emptied into a cart without the trouble of sweeping and shoveling it from the pavement. Of course the densely populated condition of some streets, which leaves the pavement the only playground for children, removes them from the list of mere streets, but the greater part of the dirt found on these streets has been placed there by people of careless and dirty tendencies, and of such an age as to make change of habits difficult. The superintendents report a marked improvement in these sections during the last two years, due to education in matters of cleanliness, brought about by the officers of the University and College Settlements, the Principals of the public schools, and especially the members of the Juvenile Leagues acting as aids to the Department.

In these and other means for the education of the people lies the hope of the crowded districts for that prevention which in the matter of cleanly streets is both better and cheaper than cure.

The same remarks apply to the presence of schools, which used to be a fruitful source of lunch papers scattered upon the street, and to the refuse of fruit carts, the orange and banana skins from which formerly embellished the pavement. Produce markets and green-grocery stores also are the sources of considerable litter which ought to go into cans.

An unpaved street, in wet weather, has much of its surface mud carried by wheels a distance of one block each way upon the cross streets.

Some of the difficulties discussed are increasing—such as the amount of population and of traffic in the up-town districts; some are decreasing—such as poor pavements, badly laid car-tracks, excessive sanding of tracks, carelessness of sprinkling-cart drivers and thoughtless littering of the streets. In the co-operation of the people, and the enforcement of the law against wilful and obstinate ones, lies the hope of still better things.

I have the honor to be, sir, very respectfully yours,

C. HERSCHEL KOYL.

To the Commissioner:

SIR—Heretofore the district superintendents have been engaged rather in cleaning the streets than in the study of means for preventing their uncleanliness, but so much interest has been created among them by the study necessary to the production of this report that I think they would welcome an opportunity to make it of permanent benefit to the Department by continued investigation of the subjects treated and of others which, I doubt not, deserve consideration.

If you desire, I shall be glad to draw up sample forms on which each superintendent may record the area of his district and its condition, block by block, in respect to all the matters which affect the work of the Department.

Such a record would give a much more accurate statement of areas than is available anywhere at present, would enable superintendents to make a scientific study of their fields of operation and a wise distribution of their men, would create a valuable spirit of thoughtfulness and of pride in their work among lesser officers, and would furnish to the Department an amount of accurate and comparative information which, as far as I am aware, exists nowhere else in the country.

C. H. K.

Suggestion approved.

G. E. W.

[In accordance with the above approved suggestion, blank forms were prepared and sent to each District Superintendent during the month of September, the headings referring to the name of the street, block limits, area, kind of pavement and its condition, density of traffic, car-tracks and condition of pavement in connection therewith, association sprinkling, elevated road pillars, character of population, schools, produce markets and market stores, push-cart trade, number of times swept daily, hours occupied in sweeping, and daily amount of sweepings collected. The results are on file in the Department, and it is believed that the information thus collected is more thorough with regard to the condition of the streets, and to the varying difficulties of cleaning them, than has ever been compiled in any city at any time in the past. The tables which follow, and which form a part of the preceding report by Mr. Koyl, contain information under headings for the most part similar, except that the unit of comparison is the district instead of the street, as in the case of the reports made by the Superintendents.]

TABLES—SERIES No. 1.

Showing by Sections the Area of Each Kind of Pavement Cleaned by the Department, and the Amount of. Each Affected by the Various Influencing Difficulties.

DISTRICT No. 1.

Section	Kind of Pavement.	Area. Square Yards.	Condition of Pavement. Good, Square Yards.	Condition of Pavement. Fair, Square Yards.	Condition of Pavement. Bad, Square Yards.	Amount of Traffic. Medium Square Yards.	Amount of Traffic. Heavy, Square Yards.	Amount of Traffic. Dense, Square Yards.	Lineal Feet of Single Car Track. Flat Rail.	Lineal Feet of Single Car Track. Grooved Rail.	Lineal Feet of Single Car Track. T Rail.	Lineal Feet of Single Car Track. Steam Rail-road.	Condition of Pavement Between Tracks. Good, Lineal Feet.	Condition of Pavement Between Tracks. Fair, Lineal Feet.	Condition of Pavement Between Tracks. Bad, Lineal Feet.	Sanding of Track. Little, Lineal Feet.	Sanding of Track. Much, Lineal Feet.	Sprinkling. Heavy, Square Yards.	Streets with L. Road Pillars, Square Yards.	Character of Population. Good, Square Yards.	Character of Population. Fair, Square Yards.	Character of Population. Bad, Square Yards.	Blocks. With Schools.	Blocks. With Produce Markets.	Blocks. With Push-cart Trade.	Blocks. Adjoining Unpaved Streets.	Sweepers Employed.	Daily average per Sweeper, Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds per Week.
1	Asphalt	18,200	4,292	13,908	.....	.....	.....	18,200	.....	....	700	....	.....	700	.....	700	.....	Little trouble.	.....	7,400	9,300	1,500	..	..	6	..	4	4,550	$3 03
	Granite	112,658	112,658	.....	.....	.....	.....	112,658	.....	....	20,518	....	.....	13,118	7,400	13,118	7,400		24,204	54,000	50,158	8 500	2	18	42	..	33	3,414	4 03
	Total	130,858	116,950	13,908	.....	.....	.....	130,858	.....	....	21,218	....	.....	13,818	7,400	13 818	7,400		24,204	.....	.....	.....	2	18	48	..	37	.....	....
2	Asphalt	17,010	7,672	9,338	.....	.....	.....	17,010	.....	....	....	....	.....	.....	.....	.....	.....	Little trouble.	.....	4,700	12,310	.....	..	..	4	..	3	5,670	$2 43
	Granite	117,337	117,337	.....	.....	.....	.....	117,337	.....	....	16,826	....	.....	16,826	.....	16,826	.....		14,500	59,000	58,337	.....	1	12	60	..	33	3,556	3 87
	Belgian	4,600	4,600	.....	.....	.....	.....	4,600	.....	....	700	....	.....	700	.....	700	.....		.....	2,300	2,300	.....	..	..	1	..	1	4,600	3 00
	Total	138,947	129,609	9,338	.....	.....	.....	138 947	.....	....	17,526	....	.....	17,526	.....	17,526	.....	.....	14,500	.....	.....	.....	1	12	65	..	37	.....	....
3	Asphalt	4,518	.....	4,518	.....	.....	.....	4,518	.....	....	....	....	.....	.....	.....	.....	.....	Little trouble.	.....	1,600	2,918	.....	..	..	2	..	1	4,518	$3 05
	Granite	117,821	96,345	21,476	.....	.....	.....	117,821	.....	....	15,510	...	.....	11,510	4,000	9,510	6,000		19,890	59,000	58,821	.....	1	28	33	..	32	3,682	3 74
	Belgian	3,951	3,951	.....	.....	.....	.....	3,951	.....	....	....	....	.....	.....	.....	.....	.....		.....	1,951	2,000	.....	..	..	2	..	1	3,951	3 48
	Total	126,290	100,296	25,994	.....	.....	.....	126,290	.....	....	15,510	....	.....	11,510	4,000	9,510	6,000	.....	19,890	.....	.....	.....	1	28	37	..	34	.....	....
5	Granite	132,245	132,245	.....	.....	.....	14,892	117,353	.....	....	24,410	4,400	.....	24,810	4,000	24,810	4,000	Little trouble.	9,894	56,000	55,472	20,773	..	5	32	..	35	3,778	$3 65
	Belgian	4,796	1,500	3,296	.....	.....	.....	4,796	.....	....	....	....	.....	.....	.....	.....	.....		.....	2,400	2,396	.....	..	..	1	..	1	4,796	2 87
	Total	137,041	133,745	3,296	.....	.....	14,892	122,149	.....	....	24,410	4,400	.....	24,810	4,000	24,810	4,000	.....	9,894	.....	.....	.....	..	5	33	..	36	.....	....

DISTRICT No. 2.

Section	Kind of Pavement.	Area. Square Yards.	Condition of Pavement. Good, Square Yards.	Condition of Pavement. Fair, Square Yards.	Condition of Pavement. Bad, Square Yards.	Amount of Traffic. Medium Square Yards.	Amount of Traffic. Heavy, Square Yards.	Amount of Traffic. Dense, Square Yards.	Lineal Feet of Single Car Track. Flat Rail.	Lineal Feet of Single Car Track. Grooved Rail.	Lineal Feet of Single Car Track. T Rail.	Lineal Feet of Single Car Track. Steam Rail-road.	Condition of Pavement Between Tracks. Good, Lineal Feet.	Condition of Pavement Between Tracks. Fair, Lineal Feet.	Condition of Pavement Between Tracks. Bad, Lineal Feet.	Sanding of Track. Little, Lineal Feet.	Sanding of Track. Much, Lineal Feet.	Sprinkling. Heavy, Square Yards.	Streets with L. Road Pillars, Square Yards.	Character of Population. Good, Square Yards.	Character of Population. Fair, Square Yards.	Character of Population. Bad, Square Yards.	Blocks. With Schools.	Blocks. With Produce Markets.	Blocks. With Push-cart Trade.	Blocks. Adjoining Unpaved Streets.	Sweepers Employed.	Daily average per Sweeper, Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds per Week.
3-5 Sub.	Asphalt	31,784	31,784	.....	.....	.....	.....	31,784	2,250	....	1,250	....	1,000	.....	2,500	1,500	2,000	No trouble.	.....	.....	15,784	16,000	Conditions now vastly improved, because of University and College Settlements, co-operation of Principals, Aids to the Department of Street Cleaning, paper cans, etc., etc.	10	10	..	10	3,178	$4 33
	Granite	70,102	70,102	.....	.....	.....	.....	70,102	7,550	....	8,800	....	1,000	8,100	7,250	8,350	8,000		.....	.....	35,102	35,000 V. B.		..	..	..	19	3,690	3 73
	Belgian	16,020	16,020	.....	.....	.....	.....	16,020	4,100	....	2,150	....	900	3,400	1,950	3,150	3,100		.....	.....	8,020	8,000 V. B.		..	..	..	5	3,204	4 30
	Other (cobble)	5,705	.....	.....	5,705	.....	.....	5,705	.....	....	....	....	.....	.....	.....	.....	.....		.....	.....	1,705	4,000 V. B.		..	..	..	3	1,902	7 24
	Total	123,611	117,906	.....	5,705	.....	.....	123,611	13,900	....	12,200	....	2,900	11,500	11,700	13,000	13,100	.....	.....	.....	.....	.....		10	10	..	37	.....	....
4	Asphalt	10,901	10,901	.....	.....	.....	10,901	.....	.....	....	....	....	.....	.....	.....	.....	.....	No trouble.	3,887	.....	.....	10,901		..	..	..	2.0	5,450	$2 53
	Granite	122,742	80,304	7,602	34,836	.....	122,742	.....	18,850	4,150	8,600	....	3,280	15,600	12,720	15,800	15,800		16,879	.....	.....	122,742		15	..	..	30.7	3,998	3 44
	Belgian	1,004	1,004	.....	.....	.....	1,004	.....	.....	....	....	....	.....	.....	.....	.....	.....		.....	.....	.....	1,004		..	..	..	0.3	3,347	4 11
	Total	134,647	92,209	7,602	34,836	.....	134,647	.....	18,850	4,150	8,600	....	3,280	15,600	12,720	15,800	15,800	.....	20,766	.....	.....	.....		15	..	..	33.0	.....	....
4 Sub.	Asphalt	10,810	10,819	.....	.....	.....	4,819	6,000	.....	....	....	....	.....	.....	.....	.....	.....	No trouble.	.....	.....	10,819	.....		..	..	..	2.0	5,410	$2 55
	Granite	135,208	121,524	.....	13,684	.....	30,208	105,000	26,250	....	5,000	....	6,350	500	24,400	15,250	16,000		.....	.....	135,208	.....		..	..	..	28.6	4,696	2 93
	Belgian	1,546	1,426	.....	120	.....	746	800	.....	....	....	....	.....	.....	.....	.....	.....		.....	.....	1,546	.....		..	..	..	0.4	3,865	3 57
	Other (cobble)	3,142	.....	.....	3,142	.....	1,542	1,600	150	....	600	....	.....	.....	750	350	400		.....	.....	3,142	.....		..	..	..	1.0	3,142	4 38
	Total	150,715	133,769	.....	16,946	.....	37,315	113,400	26,400	....	5,600	....	6,350	500	25,150	15,600	16,400	.....	.....	.....	.....	.....		..	..	..	32.0	.....	....
6	Asphalt	54,739	54,739	.....	.....	.....	19,750	34,989	300	....	3,100	....	2,000	1,400	.....	1,700	1,700	No trouble.	4,214	.....	.....	54,739 V. B.		26	36	..	17	3,220	$4 28
	Granite	27,745	27,745	.....	.....	.....	.....	27,745	5,300	4,100	3,000	....	8,500	3,900	.....	6,400	6,000		.....	.....	.....	27,745 V. B.		..	..	..	8	3,468	3 94
	Belgian	5,513	5,513	.....	.....	.....	1,200	4,313	.....	....	3,000	...	.....	3,000	.....	1,500	1,500		.....	.....	.....	5,513 V. B.		..	..	..	2	2,757	5 00
	Total	87,997	87,997	.....	.....	.....	20,950	67,047	5,600	4,100	9,100	....	10,500	8,300	.....	9,600	9,200	.....	4,214	.....	.....	.....		26	36	..	27	.....	....
8	Asphalt	62,839	62,839	.....	.....	.....	25,200	37,639	1,600	....	10,000	....	10,000	1,600	.....	6,600	5,000	No trouble.	4,764	.....	.....	62,839 V. B.		17	15	..	19	3,307	$4 16
	Granite	21,429	21,429	.....	.....	.....	6,500	14,929	5,300	1,100	2,400	....	7,200	1,600	.....	4,400	4,400		.....	.....	.....	21,429 V. B.		..	..	..	6	3,572	3 83
	Belgian	7,543	.....	.....	7,543	.....	.....	7,543	6,000	....	....	....	6,000	.....	.....	3,000	3,000		.....	.....	.....	7,543 V. B.		..	..	..	2	3,772	3 65
	Total	91,811	84,268	.....	7,543	.....	31,700	60,111	12,900	1,100	12,400	....	23,200	3,200	.....	14,000	12,400	.....	4,764	.....	.....	.....		17	15	..	27	.....	....
6-8 Sub.	Asphalt	42,692	42,692	.....	.....	11,074	31,618	.....	1,500	....	250	....	1,750	.....	.....	850	900	No trouble.	.....	.....	.....	42,692		20	16	..	10	4,269	$3 22
	Granite	46,558	28,892	8,833	8,833	40,088	6,470	.....	10,400	....	4,400	....	10,400	2,500	1,900	7,400	7,400		.....	.....	.....	46,558		..	..	..	11	4,232	3 25
	Belgian	21,980	11,542	.....	10,438	13,680	8,300	.....	7,000	....	5,000	....	8,500	2,900	600	7,000	5,000		.....	.....	.....	21,980		..	..	..	5	4,396	3 13
	Total	111,230	83,126	8,833	19,271	64,842	18,388	.....	18,900	....	9,650	....	20,650	5,400	2,500	15,250	13,300	.....	.....	.....	.....	.....		20	16	..	26	.....	....
10	Asphalt	17,142	17,142	.....	.....	.....	7,896	9,246	2,400	....	4,000	....	2,000	4,400	.....	3,200	3,200	No trouble.	.....	17,142	.....	.....		..	..	..	3	5,714	$2 41
	Granite	50,020	31,438	12,906	5,676	.....	.....	50,020	1,300	3,400	12,150	....	9,000	2,850	5,000	8,450	8,400		.....	.....	50,020	.....		..	..	..	11	4,547	3 03
	Belgian	9,873	.....	.....	9,873	.....	.....	9,873	.....	....	2,250	....	1,250	.....	1,000	1,250	1,000		9,873	9,873	.....	.....		..	..	..	2	4,937	2 70
	Total	77,035	48,580	12,906	15,549	.....	7,896	69,139	3,700	3,400	18,400	....	12,250	7,250	6,000	12,900	12,600	.....	9,873	.....	.....	.....		..	..	..	16	.....	....
10 Sub.	Asphalt	16,317	16,317	.....	.....	.....	.....	16,317	1,550	....	1,550	....	.....	3,100	.....	1,500	1,600	No trouble.	.....	.....	8,000	8,317		..	..	..	4	4,079	$3 37
	Granite	64,994	64,994	.....	.....	.....	.....	64,994	4,200	3,400	2,000	....	9,600	.....	.....	5,100	4,500		.....	.....	32,000	32,994		..	..	..	14	4,643	2 96
	Belgian	6,923	6,923	.....	.....	.....	.....	6,923	.....	....	1,550	....	.....	.....	1,550	1,000	550		.....	.....	3,500	3,423		..	..	..	2	3,462	3 98
	Total	88,234	88,234	.....	.....	.....	.....	88,234	5,750	3,400	5,100	....	9,600	3,100	1,550	7,600	6,650	.....	.....	.....	.....	.....		..	..	..	20	.....	....

TABLES—SERIES No. 1—*(Continued).*

DISTRICT No. 3.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards	Light. Square Yards.	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
7	Asphalt	13,479	13,479	.....	.....	4,493	.....	8,986	.....	....	....	....	.....	.....	.....	.....	.....	No influence.	.....	.....	13,479	.....	2	..	..	..	1 1/20	7,702	$1 79
	Granite	75,489	50,326	22,043	3,120	.....	25,163	20,326 / 30,000D	3,206	....	16,772	3,276	11,390	8,658	3,206	.....	23,254		.....	.....	63,489	12,000	2	..	2	..	14 19/20	5,100	2 70
	Belgian	29,088	.....	.....	29,088	9,696	9,696	9,696	1,986	....	6,704	....	.....	2,063	6,627	8,690	.....		10,400	.....	29,088	.....	..	..	..	..	5 9/20	5,289	2 60
	Total	118,056	63,805	22,043	32,208	14,189	34,859	69,008	5,192	....	23,476	3,276	11,390	10,721	9,833	8,690	23,254	.....	10,400	.....	.....	.....	4	..	2	..	22	.....	....
9	Asphalt	20,843	20,843	.....	.....	3,474	3,474	13,895	1,657	....	....	....	1,657	.....	.....	.....	1,657	No influence.	.....	.....	20,843	.....	1	..	..	..	1 7/20	15,439	$0 90
	Granite	144,560	31,878	84,037	28,645	36,140	36,140	42,280 / 30,000D	15,747	....	19,843	4,904	40,494	.....	.....	.....	40,494		7,800	.....	124,560	20,000	5	..	2	..	27 4/20	5,315	2 60
	Belgian	11,309	.....	.....	11,309	11,309	.....	.....	.....	....	2,207	....	.....	.....	2,207	.....	2,207		10,400	.....	11,309	.....	..	..	..	..	1 9/20	7,800	1 77
	Total	176,712	52,721	84,037	39,954	50,923	39,614	86,175	17,404	....	22,050	4,904	42,151	.....	2,207	.....	44,358	.....	18,200	.....	.....	.....	6	..	2	..	30	.....	....
7-9 Sub.	Asphalt	13,307	13,307	.....	.....	.....	.....	13,307	.....	....	....	....	.....	.....	.....	.....	.....	No influence.	.....	5,307	.....	8,000	..	..	1	..	3	4,436	$3 10
	Granite	51,331	25,667	12,832	12,832	.....	.....	25,331 / 26,000D	.....	....	15,720	....	15,720	.....	.....	.....	15,720		.....	35,331	.....	16,000	2	4	15	..	11	4,667	2 95
	Belgian	22,249	.....	.....	22,249	.....	.....	22,249	.....	....	481	....	.....	.....	481	.....	481		.....	.....	22,249	.....	....	..	..	..	4	5,562	2 48
	Total	86,887	38,974	12,832	35,081	.....	.....	86,887	.....	....	16,201	....	15,720	.....	481	.....	16,201	.....	.....	.....	.....	.....	2	4	16	..	18	.....	....
11	Asphalt	27,060	20,295	6,765	.....	.....	.....	7,060 / 20,000D	2,800	1,900	1,000	....	5,700	.....	.....	5,700	.....	No influence.	.....	27,060	.....	.....	1	..	..	..	3 [illegible]	7,465	$1 84
	Granite	106,263	52,951	26,656	26,656	17,710	17,710	50,843 / 20,000D	10,565	1,298	16,655	....	21,388	7,130	.....	.....	28,518		7,800	53,000	52,263	.....	1	..	..	..	17	6,251	2 20
	Belgian	36,478	.....	12,159	24,319	.....	36,478	.....	.....	....	2,000	....	.....	.....	2,000	.....	2,000		9,100	.....	12,000	24,478	1	..	..	..	6 1/2	5,637	2 44
	Total	169,801	73,246	45,580	50,975	17,710	54,188	97,903	13,365	3,198	19,655	....	27,088	7,130	2,000	5,700	30,518	.....	16,900	.....	.....	.....	3	..	..	..	27	.....	....
13	Asphalt	15,462	15,462	.....	.....	3,092	.....	2,370 / 10,000D	.....	....	2,300	....	.....	.....	2,300	.....	2,300	No influence.	.....	4,000	11,462	.....	..	..	..	..	2 1/2	6,185	$2 22
	Granite	110,763	36,921	36,921	36,921	18,460	18,460	53,843 / 20,000D	4,000	4,000	17,380	1,320	13,350	13,350	.....	.....	26,700		6,500	55,000	55,763	.....	3	..	8	..	18 1/2	5,987	2 30
	Belgian	33,661	.....	.....	33,661	.....	.....	33,661	.....	....	3,000	....	.....	.....	3,000	.....	3,000		6,500	8,000	23,661	2,000 V. B.	..	..	..	..	6 1/2	5,179	2 66
	Other (brick)	1,150	1,150	.....	.....	.....	.....	1,150	.....	....	....	....	.....	.....	.....	.....	.....		.....	.....	.....	.....	..	..	..	..	1/2	2,300	6 10
	Total	161,036	53,533	36,921	70,582	21,552	18,460	121,024	4,000	4,000	22,680	1,320	13,350	13,350	5,300	.....	32,000	.....	13,000	.....	.....	.....	3	..	8	..	28	.....	....
[illegible]	Asphalt	52,728	52,728	.....	.....	.....	1,000	1,728 / 50,000D	1,600	....	....	....	600	.....	1,000	.....	1,600	No influence.	.....	35,728	17,000	.....	..	..	..	..	8	6,591	$2 09
	Granite	74,827	2,000	1,000	71,827	18,706	18,706	27,415 / 10,000D	.....	....	13,850	....	7,124	3,363	3,363	.....	13,850		6,500	37,000	37,827	.....	2	..	5	..	12	6,236	2 21
	Belgian	38,202	.....	.....	38,202	.....	.....	38,202	.....	....	....	....	.....	.....	.....	.....	.....		6,500	19,000	19,202	.....	..	..	..	..	6	6,367	2 16
	Total	165,757	54,728	1,000	110,029	18,706	19,706	127,315	1,600	....	13,850	....	7,724	3,363	4,363	.....	15,450	.....	13,000	.....	.....	.....	2	..	5	..	26	.....	....

DISTRICT No. 4.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards	Light. Medium Square Yards.	Heavy. Square Yards.	Dense. Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
12	Asphalt	47,055	30,765	.....	16,290	8,866	23,728	14,461	6,138	2,660	6,542	....	15,340	.....	.....	15,340	.....	.....	.....	7,847	7,848	31,360	2	..	2	..	9.0	5,228	$2 63
	Granite	64,473	36,223	16,530	11,720	4,070	12,998	47,405	3,560	3,120	4,680	....	6,680	3,120	1,560	6,240	5,120	7,467	10,400	21,491	21,491	21,491	2	..	2	..	13.0	4,959	2 78
	Belgian	36,420	29,134	1,953	5,333	.....	34,860	1,560	.....	....	3,653	...	.....	2,053	1,600	3,653	.....	.....	.....	9,105	9,105	18,210	3	..	..	..	6.9	5,278	2 61
	Other (cobble)	687	.....	.....	687	687	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..	..	..	0.1	6,870	2 00
	Total	148,635	96,122	18,483	34,030	13,623	71,586	63,426	9,698	5,780	14,875	....	22,020	5,173	3,160	25,233	5,120	7,467	10,400	.....	.....	.....	7	..	4	..	29.0	.....	....
14	Asphalt	29,931	24,864	.....	5,067	.....	12,064	17,867	2,700	....	1,080	....	2,700	1,080	.....	3,780	.....	.....	.....	9,977	9,977	9,977	1	..	..	..	6	4,989	$2 76
	Granite	97,003	65,383	21,820	9,800	.....	43,203	53,800	9,426	5,920	18,456	....	22,542	9,100	2,160	21,036	12,766	16,134	17,334	38,800	29,103	29,100	4	..	3	..	20	4,850	2 84
	Belgian	27,005	16,952	.....	10,053	.....	17,635	9,370	.....	....	810	....	.....	810	.....	810	.....	.....	.....	6,750	6,755	13,500	..	..	..	..	5	5,401	2 55
	Other (cobble)	3,087	.....	.....	3,087	3,087	.....	.....	.....	....	1,080	....	.....	.....	1,080	1,080	.....	.....	.....	.....	.....	.....	..	..	..	..	1	3,087	4 46
	Total	157,026	107,199	21,820	28,007	3,087	72,902	81,037	12,126	5,920	21,426	....	25,242	10,990	3,240	26,706	12,766	16,134	17,334	.....	.....	.....	5	..	3	..	32	.....	....
16	Asphalt	34,308	29,430	4,878	.....	.....	11,852	22,456	2,500	....	1,250	....	2,500	.....	1,250	2,500	1,250	.....	.....	11,430	11,478	11,400	1	..	..	..	6.0	5,718	$2 41
	Granite	61,594	35,511	21,803	4,280	5,400	28,194	28,000	.....	5,000	20,350	....	7,500	16,600	1,250	19,100	6,250	16,134	17,334	32,000	14,594	15,000 V. B.	..	..	..	..	13.9	4,431	3 11
	Belgian	50,111	29,671	18,000	2,440	23,081	2,030	25,000	.....	....	12,100	....	.....	12,100	.....	12,100	.....	.....	.....	25,000	12,111	13,000	1	..	..	..	8.0	6,264	2 20
	Other (wood)	1,010	1,010	.....	.....	.....	1,010	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..	..	..	0.1	10,100	1 36
	Total	147,023	95,622	44,681	6,720	28,481	43,086	75,456	2,500	5,000	33,700	....	10,000	28,700	2,500	33,700	7,500	16,134	17,334	.....	.....	.....	2	..	..	..	28.0	.....	....
18	Asphalt	49,593	49,593	.....	.....	.....	2,573	47,020	.....	2,600	520	....	3,120	.....	.....	.....	3,120	.....	8,667	25,000	12,593	12,000	..	..	..	..	9	5,510	$2 50
	Granite	84,378	26,848	36,100	21,430	.....	9,358	75,020	.....	14,060	8,371	....	8,340	6,240	7,851	9,600	12,831	17,867	15,600	21,000	21,378	42,000	..	..	..	..	20	4,219	3 26
	Belgian	27,433	3,063	24,100	270	4,143	10,520	12,770	2,200	2,490	6,031	....	.....	4,690	6,031	8,231	2,490	....	.....	6,433	7,000	14,000	4	..	3	..	6	4,572	3 01
	Total	161,404	79,504	60,200	21,700	4,143	22,451	134,810	2,200	19,150	14,922	....	11,460	10,930	13,882	17,831	18,441	17,867	24,267	.....	.....	.....	4	..	3	..	35	.....	....
20	Asphalt	56,621	56,621	.....	.....	.....	25,058	31,563	.....	9,660	....	....	5,930	3,730	.....	5,930	3,730	.....	10,400	28,000	14,621	14,000	1	..	..	..	9	6,291	$2 19
	Granite	65,006	42,636	.....	22,370	.....	14,701	50,305	13,392	6,380	....	....	16,752	3,020	.....	4,380	15,392	17,867	10,400	33,000	16,006	16,000	1	..	..	..	13	5,000	2 76
	Belgian	34,861	.....	24,461	10,400	12,000	19,551	3,310	.....	....	4,380	....	.....	.....	4,380	4,380	.....	.....	.....	8,000	8,861	18,000	..	..	..	..	7	4,980	2 77
	Total	156,488	99,257	24,461	32,770	12,000	59,310	85,178	13,392	16,040	4,380	....	22,682	6,750	4,380	14,690	19,122	17,867	20,800	.....	.....	.....	2	..	..	..	29	.....	....

DISTRICT No. 5.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards	Light. Square Yards.	Meduim Square Yards.	Heavy. Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
17	Asphalt	51,025	45,333	5,692	.....	10,668	.....	40,357	3,120	3,400	3,120	...	6,520	.....	3,120	.....	9,640	.....	.....	.....	30,025	21,000	1	6	..	..	9	5,669	$2 43
	Granite	87,788	66,388	12,000	9,400	13,088	18,700	56,000	.....	5,316	12,840	3,120	7,100	7,936	6,240	6,240	15,036	.....	.....	23,591	4,197	60,000	1	8	..	..	17	5,164	2 67
	Belgian	33,843	.....	33,843	.....	18,400	4,000	11,443	3,120	....	3,120	....	.....	.....	6,240	.....	6,240	20,800	20,800	5,843	.....	28,000	1	9	..	..	7	4,833	2 85
	Total	172,656	111,721	51,535	9,400	42,156	22,700	107,800	6,240	8,716	19,080	3,120	13,620	7,936	15,600	6,240	30,916	20,800	20,800	.....	.....	.....	3	23	..	..	33	.....	....
19	Asphalt	15,000	10,667	4,333	.....	.....	.....	15,000	3,200	....	3,120	....	3,200	.....	3,120	.....	6,320	.....	.....	5,000	5,000	5,000	..	6	..	..	2.9	5,173	2 66
	Granite	78,585	8,000	27,523	43,062	13,300	32,257	33,028	.....	5,608	12,480	6,240	6,320	3,120	14,888	12,480	11,848	.....	.....	7,000	34,585	37,000	1	8	..	..	16.0	4,911	2 80
	Belgian	68,200	.....	13,335	54,865	5,334	21,336	41,530	.....	2,408	9,440	....	.....	3,200	8,648	.....	11,848	20,800	20,800	16,000	13,200	39,000	..	9	..	..	13.0	5,246	2 62
	Other (cobble)	400	.....	.....	400	400	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	..	..	..	..	0.1	4,000	3 44
	Total	162,185	18,667	45,191	98,327	19,034	53,593	89,558	3,200	8,016	25,040	6,240	9,520	6,320	26,656	12,480	29,216	20,800	20,800	.....	.....	.....	1	23	..	..	32.0	.....	....
21	Asphalt	24,042	14,224	9,818	.....	1,072	14,700	8,270	.....	....	3,120	....	.....	.....	3,120	.....	3,120	.....	.....	4,000	7,042	13,000	1	6	..	..	5	4,808	2 86
	Granite	60,082	.....	17,733	42,349	5,334	18,220	36,528	.....	6,480	9,360	....	3,360	2,120	9,360	9,600	6,240	.....	.....	11,000	25,082	24,000	2	8	..	..	12	5,007	2 75
	Belgian	73,979	.....	17,780	56,199	13,400	18,700	41,879	.....	....	3,120	....	.....	.....	3,120	.....	3,120	10,400	10,400	53,979	.....	20,000	1	7	..	..	14	5,284	2 61
	Other (cobble)	2,800	.....	.....	2,800	2,800	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,800	..	..	..	..	1	2,800	4 93
	Total	160,903	14,224	45,331	101,348	22,606	51,620	86,677	.....	6,480	15,600	....	3,360	3,120	15,600	9,600	12,480	10,400	10,400	.....	.....	.....	4	21	..	..	32	.....	....
23	Asphalt	31,315	18,669	12,646	.....	2,667	21,716	6,932	.....	....	3,120	....	.....	.....	3,120	.....	3,120	.....	.....	15,000	5,315	11,000	1	8	..	..	5	6,263	2 20
	Granite	62,670	35,370	6,504	20,796	.....	.....	62,670	.....	4,680	19,040	....	15,920	.....	7,800	7,800	15,920	.....	.....	21,000	15,670	26,000	..	4	..	..	13	4,821	2 86
	Belgian	82,795	.....	10,420	72,375	26,500	20,795	35,500	.....	....	6,480	....	.....	3,360	3,120	3,360	3,120	10,400	10,400	30,000	10,795	42,000	2	7	..	..	15	5,520	2 [illegible]
	Total	176,780	54,039	29,570	93,171	29,167	42,511	105,102	.....	4,680	28,640	....	15,920	3,360	14,040	11,160	22,160	10,400	10,400	.....	.....	.....	3	19	..	..	33	.....	....
25	Asphalt	28,303	18,669	9,634	.....	5,334	13,335	9,634	.....	....	3,120	....	.....	.....	3,120	.....	3,120	.....	.....	10,000	5,303	13,000	..	6	..	..	6	4,717	2 92
	Granite	36,249	.....	9,398	26,851	.....	8,001	28,248	.....	3,120	6,240	....	3,120	.....	6,240	6,240	3,120	.....	.....	4,000	2,249	30,000	..	7	..	..	9	4,028	3 42
	Belgian	84,224	.....	35,067	49,157	16,002	32,004	36,218	800	....	6,480	....	.....	3,360	3,920	4,160	3,120	10,400	10,400	40,000	18,224	26,000	2	6	..	..	14	6,016	2 29
	Other (cobble)	2,500	.....	.....	2,500	2,500	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,500	..	..	..	..	1	2,500	5 51
	Total	151,276	18,669	54,099	78,508	22,836	53,340	74,100	800	3,120	15,840	....	3,120	3,360	13,280	10,400	9,360	10,400	10,400	.....	.....	.....	2	19	..	..	30	.....	....
27	Asphalt	15,000	7,112	7,888	.....	5,334	2,734	6,932	.....	....	3,120	....	.....	.....	3,120	.....	3,120	.....	.....	10,000	2,000	3,000	1	6	..	..	2	7,500	1 84
	Granite	53,000	.....	27,233	25,767	7,667	19,133	26,200	4,000	3,120	4,680	....	6,320	.....	5,480	7,120	4,680	.....	.....	25,000	12,000	16,000	..	1	..	3	9	5,880	2 34
	Belgian	102,660	.....	29,800	72,860	9,224	34,672	58,764	4,680	2,400	8,040	....	7,080	3,360	4,680	10,440	4,680	10,400	18,733	38,000	14,660	50,000	1	6	..	..	19	5,403	2 55
	Total	170,660	7,112	64,921	98,627	22,225	56,539	91,896	8,680	5,520	15,840	....	13,400	3,360	13,280	17,560	12,480	10,400	18,733	.....	.....	.....	2	13	..	3	30	.....	....

TABLES—SERIES No. 1—*(Continued).*

DISTRICT No. 6.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement.			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards,	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Railroad.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
22	Asphalt	60,068	60,068	.....	.....	13,800	46,268	.....	1,539	....	1,539	....	3,078	.....	.....	3,078	.....	.....	.....	36,961	18,480	4,627	1	..	..	..	6.0	10,011	$1 38
	Granite	36,334	36,334	.....	.....	.....	.....	9,200 / 27,134D	3,078	3,078	1,926	....	8,082	.....	.....	8,082	.....	.....	10,502	22,250	9,084	5,000	..	6	..	..	10.8	3,364	4 09
	Belgian	69,838	11,324	38,386	20,128	9,200	60,638	.....	1,539	....	6,543	....	1,926	.....	6,156	5,004	3,078	.....	20,970	12,116	48,470	9,252	..	..	..	..	13.0	5,372	2 56
	Other (cobble)	755	.....	.....	755	.....	.....	755	.....	....	....	....	.....	.....	.....	.....	.....	....	.....	.....	755	.....	..	..	..	..	0.2	3,775	3 65
	Total	166,995	107,726	38,386	20,883	23,[illegible]	106,906	37,089	6,156	3,078	10,008	....	13,086	.....	6,156	16,164	3,078	.....	31,472	.....	.....	.....	1	6	..	..	30.0	.....	....
24	Asphalt	56,757	56,757	.....	.....	.....	56,757	.....	5,295	3,708	780	....	9,783	.....	.....	7,074	2,709	.....	.....	36,311	18,156	2,290	1	..	..	..	6.0	9,460	$1 45
	Granite	31,667	31,667	.....	.....	.....	.....	31,667D	1,122	3,708	6,228	....	11,058	.....	.....	4,830	6,228	.....	16,760	16,750	7,917	7,000	..	6	..	..	10.7	2,[illegible]	4 65
	Belgian	91,850	7,797	50,922	33,131	.....	30,617	61,233	321	....	11,295	....	4,200	.....	7,416	4,200	7,416	.....	24,711	16,538	66,152	9,160	1	..	..	..	16.0	5,741	2 40
	Other (cobble)	893	.....	.....	893	.....	.....	893	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	893	.....	..	..	..	..	0.3	2,977	4 63
	Total	181,167	96,221	50,922	34,024	.....	87,374	93,793	6,738	7,416	18,303	....	25,041	.....	7,416	16,104	16,353	.....	41,471	.....	.....	.....	2	6	..	..	33.0	.....	....
26	Asphalt	61,783	61,783	.....	.....	6,900	54,883	....	7,320	3,660	....	....	10,980	.....	.....	7,320	3,660	.....	.....	41,189	20,594	.....	1	..	..	..	6	10,297	$1 34
	Granite	31,693	7,943	12,285	11,465	.....	.....	31,693D	.....	3,660	3,660	...	.....	3,660	3,660	3,660	3,660	.....	24,631	16,354	6,339	9,000	..	6	..	..	8	3,962	[illegible] 48
	Belgian	94,304	555	39,238	54,511	19,728	24,859	49,717	291	....	3,369	....	.....	.....	3,660	.....	3,660	.....	12,267	15,641	62,563	16,100	2	..	..	..	15	6,287	2 19
	Other (cobble)	1,762	.....	1,762	.....	.....	.....	1,762	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,762	..	..	..	..	1	1,762	1 [illegible]
	Total	189,542	70,281	53,285	65,976	26,628	79,742	83,172	7,611	7,320	7,029	....	10,980	3,660	7,320	10,980	10,980	.....	36,898	.....	.....	.....	3	6	..	..	30	.....	...
28	Asphalt	65,269	24,549	35,861	4,859	.....	65,269	.....	5,628	2,814	....	....	8,442	.....	.....	8,442	.....	.....	.....	43,513	21,756	.....	..	..	..	4	7	9,324	$1 48
	Granite	35,072	7,632	18,637	8,803	.....	.....	35,072D	.....	2,814	2,814	....	.....	2,814	2,814	2,814	2,814	.....	18,740	17,058	9,014	9,000	..	6	..	1	9	3,897	3 54
	Belgian	77,924	.....	57,362	20,562	9,377	22,849	45,698	2,940	....	8,814	....	.....	8,940	2,814	8,940	2,814	.....	9,376	12,825	51,299	13,800	1	..	..	..	13	5,994	2 30
	Other (cobble)	1,354	.....	1,354	.....	.....	.....	1,354	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,354	..	..	..	..	1	1,354	10 17
	Total	179,619	32,181	113,214	34,224	9,377	88,118	82,124	8,568	5,628	11,628	....	8,442	21,754	5,628	20,296	5,628	.....	28,116	.....	.....	.....	1	6	..	5	30	.....	....
30	Asphalt	43,065	43,065	.....	.....	2,300	40,765	.....	3,672	....	3,672	....	7,344	.....	.....	3,672	3,672	5,000	.....	27,177	13,588	2,300	1	..	..	1	6.0	7,178	$1 92
	Granite	42,142	42,142	.....	.....	....	.....	7,900 / 34,242D	3,672	3,672	....	....	7,344	.....	.....	7,344	.....	.....	12,165	23,714	8,428	10,000	..	6	..	..	8.0	5,268	2 61
	Belgian	84,586	12,540	48,490	23,547	25,045	19,847	39,694	.....	651	3,672	....	651	.....	3,672	651	3,672	5,000	12,246	14,617	58,469	11,500	1	..	..	..	16.7	5,065	2 72
	Other (cobble)	881	.....	881	.....	.....	.....	881	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	881	..	..	..	..	0.3	2,937	4 69
	Total	170,674	97,747	49,380	23,547	27,345	60,612	82,717	7,344	4,323	7,344	....	15,339	.....	3,672	11,667	7,344	10,000	24,411	.....	.....	.....	2	6	..	1	31.0	.....	....

DISTRICT No. 7.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement.			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards,	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Railroad.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
29	Asphalt	34,940	34,940	.....	.....	.....	13,273	21,667	.....	....	7,000	....	7,000	.....	.....	3,400	3,600	No influence.	No influence.	33,230	1,710	.....	1	....	....	....	3¼	10,919	$1 26
	Granite	59,910	.....	59,910	.....	28,267	16,043	15,600	.....	1,560	2,640	....	.....	1,560	3,640	1,820	3,380			.....	43,510	16,400	1	S.B. 10	....	....	10¼	5,816	2 37
	Belgian	55,730	.....	.....	55,730	9,600	35,730	10,400	.....	2,600	6,520	1,560	.....	9,120	1,560	10,680	.....			.....	55,730	.....	....	6	....	....	9½	5,866	2 35
	Total	150,580	34,940	59,910	55,730	37,867	65,046	47,667	.....	4,160	17,160	1,560	7,000	10,680	5,200	15,900	6,980	.....	.....	.....	.....	.....	2	16	....	....	23	.....	....
31	Asphalt	48,970	48,970	.....	.....	11,067	16,569	21,334	.....	....	4,800	....	.....	4,800	.....	.....	4,800	No influence.	No influence.	48,970	.....	.....	....	....	....	....	5	9,794	$1 41
	Granite	74,670	5,067	69,603	.....	22,134	26,936	25,600	520	4,160	4,160	....	4,160	.....	4,680	4,680	4,160			39,870	34,800	.....	1	14	....	....	11	6,788	2 03
	Belgian	11,410	.....	.....	11,410	.....	11,410	.....	.....	....	4,160	....	.....	4,160	.....	4,160	.....			11,410	.....	.....	....	....	....	....	2	5,705	2 41
	Total	135,050	54,037	69,603	11,410	33,201	54,915	46,934	520	4,160	13,120	....	4,160	8,960	4,680	8,840	8,960	.....	.....	.....	.....	.....	1	14	....	....	18	.....	....
33	Asphalt	39,920	39,920	.....	.....	.....	15,919	24,001	.....	....	5,400	....	.....	5,400	.....	720	4,680	No influence.	No influence.	39,920	.....	.....	....	....	....	....	5⅓	7,485	$1 84
	Granite	94,600	7,601	86,999	.....	11,067	65,733	17,800	4,680	4,680	4,680	....	4,680	.....	9,360	9,360	4,680			59,800	34,800	.....	2	16	....	....	12⅓	7,670	1 80
	Belgian	20,580	.....	.....	20,580	.....	20,580	.....	.....	....	4,680	...	.....	4,680	.....	4,680	.....			20,580	.....	.....	....	....	....	....	3⅓	6,174	2 23
	Total	155,100	47,521	86,999	20,580	11,067	102,232	41,801	4,680	4,680	14,760	....	4,680	10,080	9,360	14,760	9,360	.....	.....	.....	.....	.....	2	16	....	....	21	.....	....
35	Asphalt	40,760	40,760	.....	.....	10,708	11,383	18,669	.....	....	4,200	....	.....	4,200	.....	560	3,640	No influence.	No influence.	40,760	.....	.....	1	....	....	....	4¼	9,591	$1 44
	Granite	98,430	8,089	90,341	.....	10,708	63,455	24,267	3,296	7,280	3,640	....	3,640	3,296	7,280	10,576	3,640			75,230	23,200	.....	....	14	....	....	11¼	8,750	1 57
	Belgian	10,030	.....	.....	10,030	.....	10,030	.....	.....	....	3,640	....	.....	3,640	.....	3,640	.....			10,030	.....	.....	....	....	....	....	1½	6,687	2 06
	Total	149,220	48,849	90,341	10,030	21,416	84,868	42,936	3,296	7,280	11,480	....	3,640	11,136	7,280	14,776	7,280	.....	.....	.....	.....	.....	1	14	....	....	17	.....	....
37	Asphalt	41,550	41,550	.....	.....	21,416	1,799	18,335	.....	....	4,160	....	.....	.....	4,160	.....	4,160	No influence.	No influence.	41,550	.....	.....	....	....	....	5	5[illegible]	8,228	$1 67
	Granite	79,270	9,267	70,003	.....	11,000	36,202	32,068	4,160	4,160	4,160	....	4,160	.....	8,320	8,320	4,160			51,270	28,000	.....	1	16	....	6	10	7,927	1 74
	Belgian	17,620	.....	.....	17,620	.....	17,620	.....	.....	....	4,160	....	.....	4,160	.....	4,160	.....			17,620	.....	.....	....	....	....	....	[illegible]	6,407	2 15
	Other (cobble)	1,330	.....	.....	1,330	.....	.....	1,330	.....	....	....	....	.....	.....	.....	.....	.....			.....	.....	.....	...	....	....	....	[illegible]	6,650	2 07
	Total	139,770	50,817	70,003	18,950	32,416	55,621	51,733	4,160	4,160	12,480	....	4,160	4,160	12,480	12,480	8,320	.....	.....	.....	.....	.....	1	16	....	11	18	.....	....
39	Asphalt	23,080	23,080	.....	.....	.....	9,328	13,752	.....	....	3,120	....	.....	3,120	.....	.....	3,120	No influence.	No influence.	23,080	.....	.....	....	....	....	3	3	7,693	$1 79
	Granite	60,280	2,311	57,969	.....	19,867	19,611	20,802	3,120	3,120	3,120	....	3,120	.....	6,240	6,240	3,120			39,280	21,000	.....	....	12	....	3	8½	7,092	1 94
	Belgian	20,790	.....	.....	20,790	.....	20,790	.....	.....	....	3,120	....	.....	3,120	.....	3,120	.....			20,790	.....	.....	....	....	....	....	3	6,930	1 99
	Other (cobble)	2,080	.....	.....	2,080	.....	.....	2,080	.....	....	....	....	.....	.....	.....	.....	.....			.....	.....	.....	....	....	....	....	½	4,160	3 31
	Total	106,230	25,391	57,969	22,870	19,867	49,729	36,634	3,120	3,120	9,360	....	3,120	6,240	6,240	9,360	6,240	.....	.....	.....	.....	.....	....	12	....	6	15	.....	....
41	Asphalt	58,570	58,570	.....	.....	10,440	25,730	22,400	.....	2,240	3,920	....	.....	6,160	.....	2,520	3,640	No influence.	No influence.	58,570	.....	.....	....	....	....	11	6[illegible]	8,613	$1 60
	Granite	50,650	.....	50,650	.....	19,450	.....	31,200	4,600	5,378	4,600	....	5,378	.....	9,200	9,898	4,680			29,650	21,000	.....	1	11	....	7	7	7,236	1 90
	Belgian	17,730	.....	.....	17,730	.....	17,730	.....	.....	....	4,600	....	.....	4,600	.....	4,600	.....			17,730	.....	.....	....	....	....	....	2[illegible]	6,649	2 07
	Other (cobble)	3,310	.....	.....	3,310	.....	.....	3,310	.....	....	....	....	.....	.....	.....	.....	.....			.....	.....	.....	....	....	....	....	[illegible]	6,206	2 22
	Total	130,260	58,570	50,650	21,040	29,890	43,460	56,910	4,600	7,618	13,120	....	5,378	10,760	9,200	17,018	8,320	.....	.....	.....	.....	.....	1	11	....	18	17	.....	....

DISTRICT No. 8.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement.			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards,	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Railroad.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
32	Asphalt	63,480	63,480	.....	.....	.....	54,280	9,200	880	....	3,222	....	4,102	.....	.....	3,222	880	.....	.....	25,440	12,600	25,440	No influence, because of University and College settlements, co-operation of Principals, aids to the Department of Street Cleaning, paper cans, etc.	12	..	..	9	7,053	$1 95
	Granite	87,106	62,829	24,277	.....	15,360	52,990	18,756	5,564	3,222	....	....	2,346	6,440	.....	5,964	3,222	.....	10,733	33,853	19,400	33,853		12	..	..	14	6,222	2 21
	Belgian	15,356	5,000	10,356	.....	.....	5,800	9,556	.....	....	3,222	....	.....	.....	3,222	3,222	.....	.....	10,733	.....	5,120	10,236		6	..	..	3	5,11[illegible]	2 6[illegible]
	Total	165,942	131,309	34,633	.....	15,360	113,070	37,512	6,444	3,222	6,444	....	6,448	6,440	3,222	12,008	4,102	.....	21,466	.....	.....	.....		30	..	..	26	.....	....
34	Asphalt	37,623	37,623	.....	.....	.....	25,490	12,133	3,700	....	3,700	....	.....	7,400	.....	3,700	3,700	.....	.....	15,000	7,575	15,048		6	..	..	[illegible]	6,271	$2 19
	Granite	91,796	76,497	15,299	.....	18,667	50,729	12,880 / 9,520D	3,700	3,700	....	....	3,700	3,700	.....	7,400	.....	.....	12,522	36,000	18,359	37,437		24	..	..	16	5,737	2 40
	Belgian	33,790	.....	11,481	22,309	.....	23,523	10,267	.....	....	3,700	....	.....	.....	3,700	3,700	.....	.....	12,522	.....	11,263	22,527		6	..	..	7	4,827	2 85
	Total	163,209	114,120	26,780	22,309	18,667	99,742	44,800	7,400	3,700	7,400	....	3,700	11,100	3,700	14,800	3,700	.....	25,044	.....	.....	.....		36	..	..	29	.....	....
36	Asphalt	42,542	42,542	.....	.....	.....	.....	42,542	.....	840	7,520	....	.....	8,360	.....	3,760	4,600	.....	.....	17,542	8,000	17,000		6	3	..	6	7,090	$1 94
	Granite	102,992	48,267	44,860	9,865	18,667	61,925	22,400	3,760	3,760	....	....	3,760	3,760	.....	7,520	.....	.....	12,522	42,992	20,000	40,000		24	..	..	16	6,437	2 14
	Belgian	65,512	.....	42,049	23,463	27,000	28,245	10,267	.....	....	3,760	....	.....	.....	3,760	3,760	.....	.....	12,522	20,000	21,837	23,675		6	..	..	10	6,551	2 10
	Total	211,046	90,809	86,909	33,328	45,667	90,170	75,209	3,760	4,600	11,280	....	3,760	12,120	3,760	15,040	4,600	.....	25,044	.....	.....	.....		36	..	..	32	.....	....
38	Asphalt	22,195	22,195	.....	.....	.....	10,062	12,133	.....	....	3,770	....	.....	3,770	.....	3,770	.....	.....	.....	10,195	4,000	8,000		6	..	..	3	7,398	$1 86
	Granite	127,292	93,533	30,316	3,443	42,292	63,532	21,468	7,040	3,770	3,770	....	7,290	7,290	.....	10,810	3,770	.....	12,522	60,000	25,000	42,292		24	..	..	18	7,072	1 95
	Belgian	56,467	.....	22,870	33,597	15,000	32,132	9,335	6,620	....	4,500	....	.....	.....	11,120	11,120	.....	.....	12,522	18,000	20,000	18,467		6	..	..	10	5,647	2 42
	Total	205,954	115,728	53,186	37,040	57,292	105,726	42,936	13,660	3,770	12,040	....	7,290	11,060	11,120	25,700	3,770	.....	25,044	.....	.....	.....		36	..	..	31	.....	....
40	Asphalt	22,881	22,257	624	.....	.....	12,481	10,400	.....	....	3,192	....	.....	3,192	.....	3,192	.....	.....	.....	8,000	4,000	10,881		6	..	..	3	7,627	$1 80
	Granite	92,003	18,401	46,001	27,601	32,292	41,310	18,401	880	3,192	....	....	.....	4,072	.....	880	3,192	.....	10,733	36,000	18,000	38,003		11	..	..	15	6,134	2 24
	Belgian	16,056	.....	6,614	9,142	.....	8,055	8,001	.....	....	3,192	....	.....	.....	3,192	3,192	.....	.....	10,733	.....	5,000	11,056		..	..	..	3	5,352	2 57
	Total	130,940	40,658	53,239	37,043	32,292	61,846	36,802	880	3,192	6,384	....	.....	7,264	3,192	7,264	3,192	.....	21,466	.....	.....	.....		17	..	..	21	.....	....

TABLES—SERIES No. 1—*(Continued).*

DISTRICT No. 9.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards.	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
45	Asphalt	27,590	27,590	.....	.....	16,327	2,783	8,480	3,816	....	....	....	.....	3,816	.....	3,816	.....	.....	.....	20,000	7,590	.....	3	..	..	7	2	13,795	$1 00
	Granite	95,363	.....	95,363	.....	47,083	37,613	10,667	8,324	3,800	11,284	....	3,800	19,608	.....	6,760	16,648	.....	.....	60,000	35,363	.....	8	5	..	6	12	7,947	1 73
	Belgian	27,015	.....	13,500	13,515	.....	4,833	22,182	.....	....	12,800	....	.....	12,800	.....	12,800	.....	11,100	.....	10,000	17,015	.....	..	..	..	..	4	6,754	2 04
	Total	149,968	27,590	108,863	13,515	63,410	45,229	41,329	12,140	3,800	24,084	....	3,800	36,224	.....	23,376	16,648	11,100	.....	.....	.....	.....	5	5	..	13	18	.....	....
47	Asphalt	76,364	76,364	.....	.....	.....	76,364	.....	.....	....	....	....	.....	.....	.....	.....	.....	38,000	.....	76,364	.....	.....	1	..	..	5	7	10,909	$1 26
	Granite	64,245	.....	64,245	.....	20,800	27,926	15,519	.....	....	....	....	.....	.....	.....	.....	.....	47,790	.....	64,245	.....	.....	1	..	2	8	9	7,138	1 93
	Belgian	41,810	18,917	.....	22,893	.....	.....	41,810	.....	....	12,132	....	5,264	6,868	.....	5,264	6,868	12,000	22,770	.....	41,810	.....	1	1	..	4	6	6,968	1 98
	Total	182,419	95,281	64,245	22,893	20,800	104,290	57,329	.....	....	12,132	....	5,264	6,868	.....	5,264	6,868	97,790	22,770	.....	.....	.....	3	1	2	17	22	.....	....
49	Asphalt	19,550	19,550	.....	.....	.....	12,750	6,800	.....	....	....	....	.....	.....	.....	.....	.....	19,550	.....	19,550	.....	.....	..	..	..	7	3	6,517	$2 12
	Granite	70,630	.....	53,043	17,587	.....	70,630	.....	.....	....	9,356	....	4,080	.....	5,276	9,356	.....	34,086	17,586	20,000	30,000	20,630	1	..	2	4	12	5,886	2 34
	Total	90,180	19,550	53,043	17,587	.....	83,380	6,800	.....	....	9,356	....	4,080	.....	5,276	9,356	.....	53,636	17,586	.....	.....	.....	1	..	2	11	15	.....	....
51	Asphalt	11,547	11,547	.....	.....	.....	11,547	.....	.....	....	....	....	.....	.....	.....	.....	.....	11,547	.....	11,547	.....	.....	1	..	..	8	1½	7,698	$1 79
	Granite	59,155	14,390	27,632	17,133	42,022	.....	17,133	.....	....	5,140	....	.....	.....	5,140	5,140	.....	12,300	17,133	.....	29,155	30,000	..	..	..	14	9½	6,227	2 21
	Total	70,702	25,937	27,632	17,133	42,022	11,547	17,133	.....	....	5,140	....	.....	.....	5,140	5,140	.....	23,847	17,133	.....	.....	.....	1	..	..	16	11	.....	....
52	Granite	40,533	16,200	24,333	.....	.....	40,533	.....	.....	4,680	2,600	....	4,680	.....	2,600	7,280	.....	.....	24,333	20,000	20,533	.....	..	..	..	20	7	5,790	$2 38
	Total	40,533	16,200	24,333	.....	.....	40,533	.....	.....	4,680	2,600	....	4,680	.....	2,600	7,280	.....	.....	24,333	.....	.....	.....	..	..	..	20	7	.....	....
53	Asphalt	36,622	36,622	.....	.....	36,622	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	36,622	.....	.....	..	..	..	3	2	18,311	$0 75
	Granite	78,583	78,583	.....	.....	.....	78,583	.....	.....	....	9,450	....	.....	.....	9,450	9,450	.....	.....	.....	78,583	.....	.....	..	..	..	..	8	9,823	1 40
	Total	115,205	115,205	.....	.....	36,622	78,583	.....	.....	....	9,450	....	.....	.....	9,450	9,450	.....	.....	.....	.....	.....	.....	..	..	..	3	10	.....	....
54	Asphalt	2,717	2,717	.....	.....	2,717	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....	.....	.....	2,717	.....	.....	..	..	..	..	½	5,434	$2 53
	Granite	117,738	117,738	.....	.....	117,738	.....	.....	.....	....	20,200	....	.....	.....	20,200	20,200	.....	.....	.....	117,738	.....	.....	2	..	..	..	9½	12,393	1 11
	Total	120,455	120,455	.....	.....	120,455	.....	.....	.....	....	20,200	....	.....	.....	20,200	20,200	.....	.....	.....	.....	.....	.....	2	..	..	..	10	.....	....

DISTRICT No. 10.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards.	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
42	Asphalt	14,013	12,550	.....	1,463	3,016	2,784	8,213	.....	....	....	....	.....	.....	.....	.....	.....	.....	No influence.	.....	.....	14,013	....	....	....	5	2	7,007	$1 96
	Granite	117,266	39,795	24,166	53,305	24,668	80,278	12,320	3,696	3,696	3,696	....	3,696	3,696	3,696	7,392	3,696	12,320		56,000	6,000	55,266	1	7	....	7	18	6,515	2 11
	Belgian	12,133	.....	.....	12,133	.....	.....	12,133	.....	....	7,392	....	.....	.....	7,392	7,392	.....	.....		.....	.....	12,133	....	1	....	..	4	3,033	4 54
	Total	143,412	52,345	24,166	66,901	27,684	83,062	32,666	3,696	3,696	11,088	....	3,696	3,696	11,088	14,784	3,696	12,320	.....	.....	.....	.....	1	8	....	12	24	.....	....
43	Asphalt	9,380	9,380	.....	.....	.....	.....	9,380	.....	....	....	....	.....	.....	.....	.....	.....	.....	No influence.	.....	3,130	6,250	....	....	....	1	2	4,690	$2 93
	Granite	131,613	43,871	.....	87,742	54,000	50,773	26,840	12,996	3,228	3,228	....	3,228	12,996	3,228	16,224	3,228	10,560		73,000	3,000	55,613	1	6	....	1	18	7,312	1 88
	Belgian	18,266	.....	.....	18,266	.....	7,706	10,560	.....	....	6,456	....	.....	.....	6,456	6,456	.....	.....		.....	.....	18,266	....	....	....	2	4	4,567	3 01
	Total	159,259	53,251	.....	106,008	54,000	58,479	46,780	12,996	3,228	9,684	....	3,228	12,996	9,684	22,680	3,228	10,560	.....	.....	.....	.....	1	6	....	4	24	.....	....
44	Asphalt	28,864	28,864	.....	.....	.....	21,757	7,107	.....	...	....	....	.....	.....	.....	.....	.....	.....	.....	4,000	4,000	20,864	1	....	....	4	4	7,216	$1 91
	Granite	65,333	55,768	9,565	.....	15,000	25,376	24,957	2,132	12,722	2,132	....	2,132	12,722	2,132	14,854	2,132	7,040	No influence.	35,000	8,000	22,333	1	8	3	7	9	7,259	1 89
	Belgian	38,963	9,695	20,023	9,245	.....	31,656	7,307	.....	....	4,264	....	.....	.....	4,264	4,264	.....	.....		.....	.....	38,963	....	....	2	3	8	4,870	2 83
	Total	133,160	94,327	29,588	9,245	15,000	78,789	39,371	2,132	12,722	6,396	....	2,132	12,722	6,396	19,118	2,132	7,040	.....	.....	.....	.....	2	8	5	14	21	.....	....
46	Asphalt	30,915	19,322	7,729	3,864	.....	3,495	27,420	.....	....	....	....	.....	.....	.....	.....	.....	.....	No influence.	20,000	10,915	.....	1	....	1	4	5	6,183	$2 23
	Granite	62,910	39,319	15,728	7,863	10,000	44,110	8,800	2,640	2,640	2,640	....	2,640	2,640	2,640	5,280	2,640	8,800		26,000	20,000	16,910	1	5	2	8	7	8,987	1 53
	Belgian	48,603	24,301	12,151	12,151	.....	39,803	8,800	.....	....	5,280	....	.....	.....	5,280	5,280	.....	.....		.....	.....	48,603	....	....	....	3	11	4,418	3 12
	Total	142,428	82,942	35,608	23,878	10,000	87,408	45,020	2,640	2,640	7,920	....	2,640	2,640	7,920	10,560	2,640	8,800	.....	.....	.....	.....	2	5	3	15	23	.....	....
48	Asphalt	13,268	13,268	.....	.....	.....	2,542	10,726	.....	....	....	....	.....	.....	.....	.....	.....	.....	No influence.	13,268	.....	.....	....	....	....	2	3	4,423	$3 12
	Granite	54,950	44,649	6,867	3,434	15,000	19,183	20,767	2,640	2,640	2,640	....	2,640	2,640	2,640	5,280	2,640	8,800		33,000	6,000	15,950	1	5	2	1	7	7,850	1 75
	Belgian	55,722	34,830	13,928	6,964	15 000	12,688	28,034	.....	13,200	2,640	....	.....	.....	15,840	15,840	.....	34,830		28,000	2,000	25,722	....	....	....	4	10	5,572	2 47
	Total	123,940	92,747	20,795	10,398	30,000	34,413	59,527	2,640	15,840	5,280	....	2,640	2,640	18,480	21,120	2,640	43,630	.....	.....	.....	.....	1	5	2	7	20	.....	....
50	Asphalt	49,686	43,819	.....	5,867	.....	19,356	30,330	.....	5,808	....	....	5,808	.....	.....	5,808	.....	.....	No influence.	45,686	4,000	.....	....	....	....	4	7	7,098	$1 94
	Granite	76,860	33,444	3,203	40,213	38,260	27,423	11,177	4,490	2,112	....	....	2,640	1,850	2,112	4,490	2,112	7,040		29,500	4,750	42,610	....	4	2	10	11	6,987	1 97
	Belgian	39,935	.....	12,228	27,707	.....	39,935	.....	.....	....	11,894	....	.....	10,310	1,584	11,894	.....	.....		10,000	3,000	26,935	....	....	....	2	9	4,437	3 10
	Total	166,481	77,263	15,431	73,787	38,260	86,714	41,507	4,490	7,920	11,894	....	8,448	12,160	3,696	22,192	2,112	7,040	.....	.....	.....	.....	....	4	2	16	27	.....	....

DISTRICT No. 11.

Section	Kind of Pavement.	Area, Square Yards.	Condition of Pavement			Amount of Traffic.			Lineal Feet of Single Car Track.				Condition of Pavement Between Tracks.			Sanding of Track.		Sprinkling, Heavy, Square Yards.	Streets with L Road Pillars, Square Yards.	Character of Population.			Blocks.				Sweepers Employed.	Daily average per Sweeper Square Yards Kept Clean.	Cost of Sweeping 1,000 sq. yds. per Week.
			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	Light, Square Yards.	Medium Square Yards.	Heavy, Square Yards.	Flat Rail.	Grooved Rail.	T Rail.	Steam Rail-road.	Good, Lineal Feet.	Fair, Lineal Feet.	Bad, Lineal Feet.	Little, Lineal Feet.	Much, Lineal Feet.			Good, Square Yards.	Fair, Square Yards.	Bad, Square Yards.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.			
55	Asphalt	14,557	14,557	.....	.....	.....	.....	14,557	.....	....	....	....	.....	.....	.....	.....	.....	.....	Little trouble.	.....	14,557	.....	.....	..	..	..	4	2	7,279	$1 89
	Granite	146,777	120,566	2,622	23,589	32,935	56,921	56,921	31,800	....	....	....	15,800	16,000	.....	31,800	.....			.....	71,377	70,000	5,400	3	..	..	24	13	11,291	1 22
	Belgian	110,532	51,374	20,238	38,920	10,532	50,000	50,000	.....	....	....	....	.....	.....	.....	.....	.....			.....	110,532	.....	.....	..	..	..	18	10	11,053	1 25
	Total	271,866	186,497	22,860	62,509	43,467	106,921	121,478	31,800	....	....	....	15,800	16,000	.....	31,800	.....	.....	.....	.....	.....	.....	3	..	..	46	25	.....	....
56	Asphalt	9,869	9,869	.....	.....	.....	9,869	.....	.....	....	....	....	.....	.....	.....	.....	.....		Little trouble.	.....	9,869	.....	.....	..	..	..	2	1	9,869	1 40
	Granite	156,943	127,647	6,850	22,446	54,639	52,304	50,000	11,600	....	....	....	.....	11,600	.....	11,600	.....			18,321	.....	130,943	26,000	2	..	..	26	20	7,847	1 76
	Belgian	68,449	57,455	3,844	7,150	25,633	22,816	20,000	.....	....	....	....	.....	.....	.....	.....	.....			.....	.....	68,449	.....	2	..	..	11	8	8,556	1 61
	Total	235,261	194,971	10,694	29,596	80,272	84,989	70,000	11,600	....	....	....	.....	11,600	.....	11,600	.....	.....	.....	18,321	.....	.....	.....	4	..	..	39	29	.....	....
57	Granite	99,949	83,817	15,332	800	34,949	35,000	30,000	11,200	....	....	....	3,600	7,600	.....	11,200	.....		Little trouble.	18,120	99,949	.....	.....	1	..	..	17	17	5,879	2 34
	Belgian	30,398	10,000	15,698	4,700	10,000	12,398	8,000	2,000	....	....	....	.....	.....	2,000 V. B.	2,000	.....			.....	30,398	.....	.....	..	..	..	7	6	5,066	2 72
	Total	130,347	93,817	31,030	5,500	44,949	47,398	38,000	13,200	....	....	....	3,600	7,600	2,000	13,200	.....	.....	.....	18,120	.....	.....	.....	1	..	..	24	23	.....	....
58	Granite	229,664	227,508	.....	2,156	69,000	120,664	40,000	14,200	....	....	....	.....	14,200	.....	14,200	.....		Little trouble.	43,007	229,664	.....	.....	3	..	..	40	25½	9,006	1 53
	Belgian	24,653	3,216	.....	21,437	.....	24,653	.....	16,200	....	....	....	.....	.....	16,200 V. B.	16,200	.....			.....	24,653	.....	.....	..	..	..	5	9	2,739	3 03
	Other (brick)	22,612	22,612	.....	.....	22,612	.....	.....	.....	....	....	....	.....	.....	.....	.....	.....			.....	22,612	.....	.....	..	..	..	3	1½	15,075	0 91
	Total	276,929	253,336	.....	23,593	91,612	145,317	40,000	30,400	....	....	....	.....	14,200	16,200	30,400	.....	.....		43,007	.....	.....	.....	3	..	.	48	36	.....	....

NOTE.—The remaining series of tables, for the sake of convenience, have been arranged in different form from the preceding, and will be found on the following pages:

TABLE No. 2.

Relative Difficulties of Street Cleaning Under Different Conditions (Estimates of the Superintendents).

District.	Kind of Pavement.						Condition of Pavement.			Amount of Traffic.			Kind of Rail.			Condition of Pavement Between Tracks.			Sanding.		Association Sprinkling Heavy.	Elevated Railroad.	Character of Population.			Blocks.			
	Asphalt.	Granite.	Belgian.	Brick.	Wood.	Cobble.	Good.	Fair.	Bad.	Light.	Medium.	Heavy.	None.	Flat.	Grooved.	T Rail.	Steam.	Good.	Fair.	Bad.	Little.	Much.			Good.	Fair.	Bad.	With Schools.	With Produce Markets.	With Push-cart Trade.	Adjoining Unpaved Streets.
1	100	150	160	....	....	....	100	125	150	100	150	200	100	120	115	125	160	100	120	140	115	125	120	...	100	250	300	150	160	125	....
2	100	200	200	....	....	....	100	115	125	100	150	200	100	105	110	120	...	100	....	....	110	125	125	...	100	200	400	105	110	200	....
3	100	130	150	100	....	....	100	125	140	100	140	180	100	110	115	130	150	100	120	140	110	125	....	...	100	200	400	130	160	200	....
4	100	130	140	....	100	400	100	110	130	100	140	200	100	105	110	115	...	100	110	120	110	120	125	110	100	140	275	110	....	....	....
5	100	135	135	....	....	....	100	125	145	100	130	145	100	105	110	110	110	100	105	110	110	120	130	...	100	180	240	105	125	....	160
6	100	200	220	....	....	....	100	125	150	100	150	200	100	120	105	125	...	100	110	120	105	115	120	...	100	150	300	105	125	....	150
7	100	170	200	....	....	....	100	115	130	100	125	150	100	105	105	150	...	100	105	110	110	120	....	...	100	140	275	....	120	....	300
8	100	135	125	....	....	....	100	115	130	100	150	190	100	110	115	120	...	100	110	120	110	120	130	110	100	200	300	105	105	....	....
9	100	125	130	....	....	....	100	125	150	100	130	150	100	....	...	110	...	100	110	120	115	120	125	...	100	200	300	105	120	....	200
10	100	125	130	....	....	400	100	115	140	100	140	175	100	110	110	120	...	100	105	110	105	105	125	...	100	150	200	110	120	....	185
11	100	150	170	100	....	....	100	125	150	100	135	190	100	110	110	....	...	100	110	120	....	....	....	...	100	180	275	105	105	....	200
Average	100	150	160	100	100	400	100	120	140	100	140	180	100	110	110	120	140	100	110	120	110	120	125	110	100	200	300	110	125	175	200

TABLES—

SERIES No. 3.

Showing by Sections for Each Kind of Pavement the Existing Difficulties Expressed in Uniform Measure.

DISTRICT No. 1—

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement Between Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Character of Population.	Difficulty Added by— Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Add 25 per Cent. for Day Sweeping.	Final Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks
1	Asphalt	18,200	.....	2,782	27,300	389	195	195	Little trouble.	.....	12,300	....	.....	9,000	....	70,361	17,590	87,951	4.4	4.0	4,136	4,550	.....	Because of density of traffic this district is swept at night, while 20 per cent. of the men are busy during the day in such cleaning as the condition of traffic allows.
	Granite	112,658	56,329	....	168,987	11,393	7,760	7,760		2,420	67,155	400	9,000	63,000	....	506,868	126,717	633,585	31.7	33.0	3,554	3,414	.....	
	Total	130,858	56,329	2,782	196,287	11,783	7,955	7,955	.....	2,420	79,455	400	9,000	72,000	....	577,229	144,307	721,536	36.1	37.0	3,625	3,537	.....	
2	Asphalt	17,010	.....	1,868	25,515	.....	.....	.....	Little trouble.	.....	12,310	....	.....	6,000	....	62,703	15,676	78,379	3.9	3.0	4,362	5,670	7,373	
	Granite	117,337	58,669	....	176,006	9,348	4,674	4,674		1,450	58,337	200	6,000	90,000	....	526,695	131,674	658,369	32.9	33.0	3,567	3,550	5,337	
	Belgian	4,600	2,760	....	6,900	389	195	195		.....	2,300	....	.....	1,500	....	18,859	4,710	23,549	1.2	1.0	3,833	4,600	2,899	
	Total	138,947	61,429	1,868	208,421	9,737	4,869	4,869	.....	1,450	72,947	200	6,000	97,500	....	608,237	152,060	760,297	38.0	37.0	3,657	3,755	5,203	
3	Asphalt	4,518	.....	904	6,777	.....	.....	.....	Little trouble.	.....	2,918	....	.....	3,000	....	18,117	4,529	22,646	1.1	1.0	4,107	4,518	.....	
	Granite	117,821	58,911	4,296	176,732	8,618	5,420	5,975		1,989	58,821	200	14,000	49,500	....	502,283	125,571	627,854	31.4	32.0	3,752	3,682	.....	
	Belgian	3,951	2,371	....	5,926	.....	.....	.....		.....	2,000	....	.....	3,000	....	17,248	4,312	21,560	1.1	1.0	3,592	3,951	.....	
	Total	126,290	61,282	5,200	189,435	8,618	5,420	5,975	.....	1,989	63,739	200	14,000	55,500	....	537,648	134,412	672,060	33.6	34.0	3,756	3,714	.....	
5	Granite	132,245	66,123	....	190,922	20,893	9,114	9,114	Little trouble.	990	97,018	....	2,500	48,000	....	576,919	144,230	721,149	36.1	35.0	3,663	3,778	.....	
	Belgian	4,796	2,878	660	7,194	.....	.....	.....		.....	2,396	....	.....	1,500	....	19,424	4,856	24,280	1.2	1.0	3,997	4,796	.....	
	Total	137,041	69,001	660	198,116	20,893	9,114	9,114	.....	990	99,414	....	2,500	49,500	....	596,343	149,086	745,429	37.3	36.0	3,674	3,807	.....	
	District total	533,136	.....	....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	....	.....	.....	2,899,321	144.9	144.0	3,680	3,702	5,203	

TABLES—

DISTRICT No. 2—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
3-5 Sub.	Asphalt	31,784	.....	.....	47,676	1,208	1,389	1,528	No trouble.	.....	63,784	Conditions vastly improved, because of University and College settlements, co-operation of Principals, Aids to the Department Street Cleaning, paper-cans, etc.	5,000	15,000	.....	167,369	8.4	10.0	3,784	3,178	.....	Swept three times.
	Granite	70,102	35,051	.....	105,153	6,986	6,278	6,764		.....	140,102		.....	.....	.....	370,436	18.5	19.0	3,789	3,690	.....	
	Belgian	16,020	9,612	.....	24,030	2,334	2,028	2,598		.....	32,020		.....	.....	.....	88,642	4.4	5.0	3,641	3,204	.....	
	Other (cobble)	5,705	17,115	2,282	8,558	.....	.....	.....		.....	13 705		.....	.....	.....	47,365	2.4	3.0	2,377	1,902	.....	
	Total	123,611	61,778	2,282	185,417	10,528	9,695	10,890	.....	.....	249,611		5,000	15,000	.....	673,812	33.7	37.0	3,668	3,341	.....	
4	Asphalt	10,901	.....	.....	10,901	.....	.....	.....	No trouble.	389	21,802		.....	.....	.....	43,993	2.2	2.0	4,955	5,450	2,468	Swept twice.
	Granite	122,742	61,371	15,455	122,742	11,167	10,900	13,167		1,688	245,484		7,500	.....	.....	612,216	30.6	30.7	4,011	3,998	2,228	
	Belgian	1,004	602	.....	1,004	.....	.....	.....		.....	2,008		.....	.....	.....	4,618	0.2	0.3	5,020	3,347	.....	
	Total	134,647	61,973	15,455	134,647	11,167	10,900	13,167	.....	2,077	269,294		7,500	.....	.....	660,827	33.0	33.0	4,080	4,080	2,348	
4 Sub.	Asphalt	10,819	.....	.....	13,819	.....	.....	.....	No trouble.	.....	10,819		.....	.....	.....	35,457	1.8	2.0	6,011	5,410	.....	Swept twice; granite, dense traffic thoroughfare for steamboat trucks and carts.
	Granite	135,208	67,604	5,474	187,708	10,070	13,694	13,125		.....	135,208		.....	.....	.....	568,091	28.4	28.6	4,761	4,696	.....	
	Belgian	1,546	928	48	1,946	.....	.....	.....		.....	1,546		.....	.....	.....	6,014	0.3	0.4	5,153	3,865	.....	
	Other (cobble)	3,142	9,426	1,257	3,942	375	416	320		.....	3,142		.....	.....	.....	22,020	1.1	1.0	2,857	3,142	.....	
	Total	150,715	77,958	6,779	207,415	10,445	14,110	13,445	.....	.....	150,715		.....	.....	.....	631,582	31.6	32.0	4,769	4,710	.....	
6	Asphalt	54,739	.....	.....	72,234	1,805	389	1,417	No trouble.	421	109,480		13,000	54,000	.....	307,485	15.4	17.0	3,554	3,220	3,392	Swept three times.
	Granite	27,745	13,873	.....	41,618	4,278	1,083	5,111		.....	55,490		.....	.....	.....	149,198	7.5	8.0	3,700	3,468	1,977	
	Belgian	5,513	3,308	.....	7,670	1,667	834	1,250		.....	11,026		.....	.....	.....	31,268	1.6	2.0	3,446	2,757	.....	
	Total	87,997	17,181	.....	121,522	7,750	2,306	7,778	.....	421	175,996		13,000	54,000	.....	487,951	24.5	27.0	3,592	3,259	2,685	
8	Asphalt	62,839	.....	.....	81,658	6,000	445	4,611	No trouble.	476	188,517		8,500	22,500	.....	375,546	18.8	19.0	3,343	3,307	.....	Swept three times.
	Granite	21,429	10,714	.....	28,894	3,111	445	3,667		.....	64,287		.....	.....	.....	132,547	6.6	6.0	3,247	3,572	.....	
	Belgian	7,543	4,526	3,017	11,315	1,667	.....	2,500		.....	22,629		.....	.....	.....	53,197	2.7	2.0	2,794	3,772	.....	
	Total	91,811	15,240	3,017	121,867	10,778	890	10,778	.....	476	275,433		8,500	22,500	.....	561,290	28.1	27.0	3,267	3,400	.....	

TABLES—

DISTRICT No. 2—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by— Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent, Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
6-8 Sub.	Asphalt	42,692	.....	.....	37,155	556	.....	736	No trouble.	.....	85,384	Conditions vastly improved, because of University and College settlements, co-operation of Principals, Aids to the Department Street Cleaning, paper-cans, etc.	8,000	24,000	.....	198,523	9.9	10.0	4,312	4,269	.....	Swept three times.
	Granite	46,558	23,279	5,300	26,514	5,334	1,750	6,167		.....	93,116		.....	.....	.....	208,018	10.4	11.0	4,477	4,232	.....	
	Belgian	21,980	13,188	4,175	15,140	4,722	1,139	4,722		.....	43,960		.....	.....	.....	109,026	5.5	5.0	3,996	4,396	.....	
	Total	111,230	36,467	9,475	78,809	10,612	2,889	11,625	.....	.....	222,460		8,000	24,000	.....	515,567	25.8	26.0	4,308	4,278	.....	
10	Asphalt	17,142	.....	.....	21,765	2,889	1,222	2,667	No trouble.	.....	.....		.....	.....	.....	45,685	2.3	3.0	7,453	5,714	.....	Swept three times.
	Granite	50,020	25,010	4,852	75,030	8,056	3,570	7,014		.....	50,020		.....	.....	.....	223,572	11.2	11.0	4,466	4,547	.....	
	Belgian	9,873	5,924	3,949	14,810	1,250	556	903		987	.....		.....	.....	.....	38,252	1.9	2.0	5,196	4,937	.....	
	Total	77,035	30,934	8,801	111,605	12,195	5,348	10,584	.....	987	50,020		.....	.....	.....	307,509	15.4	16.0	5,002	4,815	.....	
10 Sub.	Asphalt	16,317	.....	.....	24 476	1,291	861	1,305	No trouble.	.....	24,317		.....	.....	.....	68,567	3.4	4.0	4,799	4,079	.....	Swept twice.
	Granite	64,994	32,497	.....	97,491	3,222	.....	3,916		.....	96,994		.....	.....	.....	299,114	15.0	14.0	4,333	4,643	.....	
	Belgian	6,923	4,154	.....	10,385	861	861	589		.....	10,346		.....	.....	.....	34,119	1.7	2.0	4,072	3,462	.....	
	Total	88,234	36,651	.....	132,352	5,374	1,722	5,810	.....	.....	131,657		.....	.....	.....	401,800	20.1	20.0	4,390	4,422	.....	
	District total	8[illegible]5,280	.....	.....	.....	.....	.....	.....	.....	.....	.....		.....	.....	.....	4,240,338	212.0	218.0	4,082	3,969	2,516	

TABLES—

DISTRICT No. 3—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
7	Asphalt	13,479	.....	.....	7,189	.....	.....	.....	No influence.	.....	13,479	400	.....	.....	.....	34,547	1.7	1.7	7,929	7,929	7,386	
	Granite	75,489	37,745	5,656	71,326	15,669	4,186	12,920		.....	87,489	400	.....	3,000	.....	313,880	15.7	14.8	4,808	5,100	6,534	
	Belgian	29,088	17,453	11,635	11,635	4,115	4,255	2,424		1,040	29,088	....	.....	.....	.....	110,733	5.5	5.5	5,289	5,289	5,851	
	Total	118,056	55,198	17,291	90,150	19,784	8,441	15,344	.....	1,040	130,056	800	.....	3,000	.....	459,160	23.0	22.0	5,133	5,366	6,590	
9	Asphalt	20,843	.....	.....	12,506	455	.....	920	No influence.	.....	20,843	200	.....	.....	.....	55,767	2.8	1.4	7,444	14,888	5,040	
	Granite	144,560	72,280	28,265	93,280	23,574	.....	22,497		780	164,560	1,000	.....	3,000	.....	553,796	27.7	27.2	5,219	5,315	2,804	
	Belgian	11,309	6,785	4,524	.....	1,226	1,226	1,226		1,040	11,309	....	.....	.....	.....	38,645	1.9	1.4	5,952	7,800	5,564	
	Total	176,712	79,065	32,789	105,786	25,255	1,226	24,643	.....	1,820	196,712	1,200	.....	3,000	.....	648,208	32.4	30.0	5,454	5,890	4,469	
7-9 Sub.	Asphalt	13,307	.....	.....	13,307	.....	.....	.....	No influence.	.....	16,000	....	.....	1,500	.....	44,114	2.2	3.0	6,049	4,436	5,736	
	Granite	51,331	25,665	7,699	64,331	8,733	.....	8,733		.....	32,000	400	2,000	22,500	.....	223,392	11.2	11.0	4,583	4,667	5,235	
	Belgian	22,249	13,349	8,900	22,249	267	267	267		.....	22,249	....	.....	.....	.....	89,797	4.5	4.0	4,944	5,562	5,107	
	Total	86,887	39,014	16,599	99,887	9,000	267	9,000	.....	.....	70,249	400	2,000	24,000	.....	357,303	17.9	18.0	4,854	4,827	5,359	
11	Asphalt	27,060	.....	1,353	35,648	1,861	.....	1,584	No influence.	.....	.....	200	.....	.....	.....	67,706	3.4	3.6	7,959	7,465	7,381	
	Granite	106,263	53,131	15,994	77,758	12,549	1,831	15,843		780	53,263	200	.....	.....	.....	337,612	16.9	17.0	6,288	6,251	5,066	
	Belgian	36,478	21,887	12,160	14,588	1,111	1,111	1,111		910	60,956	200	.....	.....	.....	150,512	7.5	6.4	4,864	5,637	7,568	
	Total	169,801	75,018	29,507	127,994	15,521	2,942	18,538	.....	1,690	114,219	600	.....	.....	.....	555,830	27.8	27.0	6,108	6,289	6,672	
13	Asphalt	15,462	.....	.....	16,896	1,278	1,278	1,278	No influence.	.....	11,462	....	.....	.....	.....	47,654	2.4	2.5	6,443	6,185	5,237	
	Granite	110,763	55,382	22,153	80,558	14,077	3,709	14,833		650	55,763	600	.....	12,000	.....	370,488	18.5	18.5	5,987	5,987	5,640	
	Belgian	33,661	20,197	13,464	26,929	1,667	1,667	1,667		650	29,661	....	.....	.....	.....	129,563	6.5	6.5	5,179	5,179	5,640	
	Other (brick)	1,150	.....	.....	920	.....	.....	.....		.....	.....	....	.....	.....	.....	2,070	0.1	0.5	11,500	2,300	.....	
	Total	161,036	75,579	35,617	125,303	17,022	6,654	17,778	.....	1,300	96,886	600	.....	12,000	.....	549,775	27.5	28.0	5,855	5,751	5,506	
15	Asphalt	52,728	.....	.....	76,782	445	556	889	No influence.	.....	17,000	....	.....	.....	.....	148,400	7.4	8.0	7,126	6,591	8,700	
	Granite	74,827	37,414	28,931	52,415	7,695	2,802	7,695		650	37,827	400	.....	7,500	.....	258,156	12.9	12.0	5,800	6,236	8,190	
	Belgian	38,202	22,921	15,281	30,562	.....	.....	.....		650	19,202	....	.....	.....	.....	126,818	6.3	6.0	6,064	6,367	8,200	
	Total	165,757	60,335	44,212	159,759	8,140	3,358	8,584	.....	1,300	74,029	400	.....	7,500	.....	533,374	26.7	26.0	6,208	6,375	8,363	
District total		878,249	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	3,103,650	155.2	151.0	5,658	5,816	6,160	

TABLES—

DISTRICT No. 4—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper.: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
12	Asphalt	47,055	.....	6,516	44,221	6,079	.....	4,261	.....	.....	70,568	400	.....	3,000	.....	182,100	9.1	9.[illegible]	5,171	5,228	6,866	
	Granite	64,473	32,237	7,994	83,134	4,456	1,634	4,578	1,867	1,040	64,473	400	.....	3,000	.....	269,286	13.5	13.0	4,776	4,959	5,820	
	Belgian	36,420	21,852	2,524	30,228	2,030	1,459	1,015	.....	.....	45,525	600	.....	.....	.....	141,653	7.1	6.9	5,130	5,278	5,475	
	Other (cobble)	687	2,061	275	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	3,[illegible]23	0.1	0.1	6,870	6,870	.....	
	Total	148,635	56,150	17,309	157,583	12,565	3,093	9,854	1,867	1,040	180,566	1,400	.....	6,000	.....	596,062	29.8	29.0	4,990	5,123	6,054	
14	Asphalt	29,931	.....	2,027	36,452	1,350	300	1,050	.....	.....	29,931	200	.....	.....	.....	101,241	5.1	6.0	5,869	4,989	7,760	Traffic toward river very dirty, such as sand, coal, coke, etc.
	Granite	97,003	48,501	8,284	115,262	14,517	3,228	12,936	4,034	1,733	7,3[illegible]9	800	.....	4,500	.....	398,107	19.9	20.0	4,875	4,850	6,610	
	Belgian	27,005	16,203	4,021	28,163	450	225	225	.....	.....	33,775	....	.....	.....	.....	110,067	5.5	5.0	4,910	5,401	5,522	
	Other (cobble)	3,087	9,261	1,235	.....	600	600	300	.....	.....	.....	....	.....	.....	.....	15,083	0.7	1.0	4,410	3,087	.....	
	Total	157,026	73,965	15,567	179,877	16,917	4,353	14,511	4,034	1,733	1[illegible]1,015	1,000	.....	4,500	.....	624,498	31.2	32.0	5,033	4,907	6,631	
16	Asphalt	34,308	.....	976	43,166	1,400	695	1,390	.....	.....	34,434	200	.....	.....	.....	116,569	5.8	6.0	5,915	5,718	8,372	
	Granite	61,594	30,797	6,073	58,715	12,694	5,362	9,334	4,034	1,733	59,594	....	.....	.....	.....	249,930	12.5	13.9	4,928	4,431	5,156	
	Belgian	50,111	30,066	4,576	47,956	6,722	3,361	3,361	.....	.....	38,111	200	.....	.....	.....	184,464	9.2	8.0	5,447	6,264	7,923	
	Other (wood)	1,010	.....	.....	808	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	1,818	0.1	0.1	10,100	10,100	.....	
	Total	147,023	60,863	11,625	150,645	20,816	9,418	14,085	4,034	1,733	132,139	400	.....	.....	.....	552,781	27.6	28.0	5,327	5,251	7,150	
18	Asphalt	49,593	.....	.....	72,588	1,012	.....	1,733	.....	867	36,593	....	.....	.....	.....	162,386	8.1	9.0	6,123	5,510	10,093	Rear of Madison Square Garden very dirty traffic; theatre exits strewed with programmes, etc
	Granite	84,378	42,189	15,792	120,016	8,555	6,096	9,795	4,467	1,560	105,378	....	.....	.....	.....	398,226	19.9	20.0	4,240	4,219	4,400	
	Belgian	27,433	16,460	4,928	29,228	4,653	4,653	3,670	.....	.....	35,000	800	.....	4,500	.....	131,325	6.6	6.0	4,157	4,572	4,685	
	Total	161,404	58,649	20,720	221,832	14,220	10,749	15,198	4,467	2,427	176,971	800	.....	4,500	.....	691,937	34.6	35.0	4,665	4,612	6,363	
20	Asphalt	56,621	.....	.....	67,391	2,728	1,037	3,720	.....	1,040	42,621	200	.....	.....	.....	175,358	8.8	9.0	6,434	6,291	7,366	Fifth avenue swift and dangerous traffic
	Granite	65,006	32,503	8,948	87,219	5,493	839	9,768	4,467	1,040	48,006	200	.....	.....	.....	263,489	13.2	13.0	4,925	5,000	5,656	
	Belgian	34,861	20,917	9,053	25,406	2,433	2,433	1,216	.....	.....	44,861	....	.....	.....	.....	141,180	7.1	7.0	4,910	4,980	5,716	
	Total	156,488	53,420	18,001	180,016	10,654	4,309	14,704	4,467	2,080	135,488	400	.....	.....	.....	580,027	29.1	29.0	5,378	5,396	6,246	
	District total	770,576	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	3,045,305	152.3	153.0	5,060	5,036	6,494	

TABLES—

DISTRICT No. 5—

SERIES No. 3—(*Continued*).

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Equivalents. Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
17.	Asphalt	51,025	.....	1,139	32,286	3,544	1,733	5,356	.....	.....	72,025	200	3,000	.....	.....	170,308	8.5	9.0	6,003	5,669	8,420	
	Granite	87,788	43,894	6,160	52,680	13,810	9,293	10,087	.....	.....	124,197	200	4,000	.....	.....	352,109	17.6	17.0	4,982	5,164	8,420	
	Belgian	33,843	20,306	6,769	10,754	5,200	7,088	7,088	5,200	2,080	56,000	200	4,500	.....	.....	159,028	7.9	7.0	4,284	4,833	8,420	
	Total	172,656	64,200	14,068	95,720	22,554	18,114	22,531	5,200	2,080	252,222	600	11,500	.....	.....	681,445	34.0	33.0	5,078	5,232	8,420	
19.	Asphalt	15,000	.....	867	12,000	2,622	3,544	3,511	.....	.....	15,000	....	3,000	.....	.....	55,544	2.8	2.9	5,307	5,173	7,200	
	Granite	78,585	39,292	22,730	43,326	18,886	10,043	10,050	.....	.....	108,585	200	4,000	.....	.....	335,697	16.8	16.0	4,678	4,911	7,450	
	Belgian	68,200	40,920	24,613	41,758	5,918	5,693	6,582	5,200	2,080	91,200	....	4,500	.....	.....	296,664	14.8	13.0	4,608	5,246	8,420	
	Other (cobble)	400	1,200	160	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	1,760	0.1	0.1	4,000	4,000	.....	
	Total	162,185	81,412	48,370	97,084	27,426	19,280	20,143	5,200	2,080	214,785	200	11,500	.....	.....	689,665	34.5	32.0	4,701	5,068	7,690	
21.	Asphalt	24,042	.....	1,964	12,496	1,733	3,544	3,544	.....	.....	33,042	200	3,000	.....	.....	83,565	4.2	5.0	5,724	4,808	8,420	
	Granite	60,082	30,041	20,486	36,510	7,111	4,067	6,133	.....	.....	73,082	400	4,000	.....	.....	241,912	12.1	12.0	4,965	5,007	4,200	
	Belgian	73,979	44,387	26,036	41,080	1,733	3,544	3,544	2,600	1,040	40,000	200	3,500	.....	.....	241,643	12.1	14.0	6,114	5,284	8,420	
	Other (cobble)	2,800	8,400	1,120	.....	.....	.....	.....	.....	.....	5,600	....	.....	.....	.....	17,920	0.9	1.0	3,111	2,800	.....	
	Total	160,903	82,828	49,606	90,086	10,577	11,155	13,221	2,600	1,040	151,724	800	10,500	.....	.....	585,040	29.3	32.0	5,492	5,028	7,013	
23.	Asphalt	31,315	.....	2,530	14,132	1,733	3,544	3,544	.....	.....	27,315	200	4,000	.....	.....	88,313	4.4	5.0	7,117	6,263	8,420	
	Granite	62,670	31,335	9,619	50,136	11,878	4,333	11,011	.....	.....	67,670	....	2,000	.....	.....	250,652	12.5	13.0	5,014	4,821	6,007	
	Belgian	82,795	49,677	33,034	36,718	3,822	2,667	2,667	2,600	1,040	94,795	400	3,500	.....	.....	313,715	15.7	15.0	5,274	5,520	5,814	
	Total	176,780	81,012	45,183	100,986	17,433	10,544	17,222	2,600	1,040	189,780	600	9,500	.....	.....	652,680	32.6	33.0	5,423	5,357	6,747	
25.	Asphalt	28,303	.....	1,927	13,042	1,733	3,544	3,544	.....	.....	31,303	....	3,000	.....	.....	86,396	4.3	6.0	6,582	4,717	6,013	
	Granite	36,249	18,125	12,620	25,799	4,333	7,088	7,088	.....	.....	62,249	....	3,500	.....	.....	177,051	8.9	9.0	4,073	4,028	5,240	
	Belgian	84,224	50,534	26,676	41,776	4,044	3,111	2,889	2,600	1,040	70,224	400	3,000	.....	.....	290,518	14.5	14.0	5,809	6,016	6,013	
	Other (cobble)	2,500	7,500	1,000	.....	.....	.....	.....	.....	.....	5,000	....	.....	.....	.....	16,000	0.8	1.0	3,125	2,500	.....	
	Total	151,276	76,159	42,223	80,617	10,110	13,743	13,521	2,600	1,040	168,776	400	9,500	.....	.....	569,965	28.5	30.0	5,308	5,043	5,755	
27.	Asphalt	15,000	.....	1,578	6,639	1,733	3,544	3,544	.....	.....	8,000	200	3,000	.....	.....	43,238	2.2	2.0	6,818	7,500	5,240	
	Granite	53,000	26,500	15,754	28,614	4,578	3,044	4,578	.....	.....	44,000	....	500	.....	4,500	185,068	9.2	9.0	5,761	5,889	5,240	
	Belgian	102,660	61,596	35,104	60,880	6,434	3,533	5,500	2,600	1,873	114,660	200	3,000	.....	.....	398,040	19.9	19.0	5,160	5,403	6,013	
	Total	170,660	88,096	52,436	96,133	12,745	10,121	13,622	2,600	1,873	166,660	400	6,500	.....	4,500	626,346	31.3	30.0	5,452	5,689	5,498	
	District total	994,460	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	3,805,141	190.3	190.0	5,225	5,234	6,854	

TABLES—

DISTRICT No. 6—

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.
22	Asphalt	60,068	.....	.....	18,507	1,284	.....	805	.....	.....
	Granite	36,334	18,167	.....	48,061	2,780	.....	2,245	.....	1,050
	Belgian	69,838	41,903	15,728	24,255	4,063	3,420	3,100	.....	2,097
	Other (cobble)	755	2,265	302	604	.....	.....	.....	.....	.....
	Total	166,995	62,335	16,030	91,427	8,127	3,420	6,150	.....	3,147
24	Asphalt	56,757	.....	.....	22,703	2,934	.....	3,470	.....	.....
	Granite	31,667	15,834	.....	47,501	4,802	.....	4,802	.....	1,676
	Belgian	91,850	55,110	23,437	61,233	6,364	4,120	5,287	.....	2,471
	Other (cobble)	893	2,679	357	714	.....	.....	.....	.....	.....
	Total	181,167	73,623	23,794	132,151	14,100	4,120	13,559	.....	4,147
26	Asphalt	61,783	.....	.....	21,953	3,050	.....	4,067	.....	.....
	Granite	31,693	15,846	7,043	47,540	3,050	3,050	3,050	.....	2,463
	Belgian	94,304	56,582	29,952	49,717	2,134	2,033	2,033	.....	1,227
	Other (cobble)	1,762	5,286	352	1,410	.....	.....	.....	.....	.....
	Total	189,542	77,714	37,047	120,620	8,234	5,083	9,150	.....	3,690
28	Asphalt	65,269	.....	9,116	26,108	2,345	.....	2,345	.....	.....
	Granite	35,072	17,536	7,249	52,608	2,345	2,345	2,345	.....	1,874
	Belgian	77,924	46,754	19,697	45,698	5,714	4,047	4,047	.....	938
	Other (cobble)	1,354	4,062	271	1,083	.....	.....	.....	.....	.....
	Total	179,619	68,352	36,333	125,497	10,404	6,392	8,737	.....	2,812
30	Asphalt	43,065	.....	.....	16,306	3,060	.....	3,060	1,250	.....
	Granite	42,142	21,071	.....	57,683	2,040	.....	2,040	.....	1,217
	Belgian	84,586	50,752	19,119	39,694	2,221	2,040	2,221	1,250	1,225
	Other (cobble)	881	2,643	176	705	.....	.....	.....	.....	.....
	Total	170,674	74,466	19,295	114,388	7,321	2,040	7,321	2,500	2,442
	District total	887,997	.....	.....	.....	.....	.....	.....	.....	.....

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Difficulty Added By— Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
27,734	200	.....	.....	.....	108,598	5.4	6.0	11,124	10,011	7,797	
19,084	....	3,000	.....	.....	130,721	6.5	10.8	5,590	3,364	3,363	
66,974	....	.....	.....	.....	231,378	11.6	12.0	6,021	5,372	6,320	
755	....	.....	.....	.....	4,681	0.2	0.2	3,775	3,775	.....	
114,547	200	3,000	.....	.....	475,378	23.8	30.0	7,017	5,567	5,827	
22,736	200	.....	.....	.....	108,800	5.4	6.0	10,510	9,460	7,200	
21,917	....	3,000	.....	.....	131,199	6.6	10.7	4,798	2,960	3,747	
84,472	200	.....	.....	.....	334,544	16.8	16.0	5,467	5,741	6,420	
893	....	.....	.....	.....	5,536	0.3	0.3	2,977	2,977	.....	
130,018	400	3,000	.....	.....	580,079	29.0	33.0	6,247	5,490	5,789	
20,594	200	.....	.....	.....	111,647	5.6	6.0	11,033	10,297	3,998	
24,339	...	3,000	.....	.....	141,074	7.1	8.0	5,872	3,962	4,304	
94,763	400	.....	.....	.....	332,845	16.6	15.0	5,681	6,287	6,036	
3,524	....	.....	.....	.....	12,334	0.6	1.0	2,937	1,762	.....	
143,220	600	3,000	.....	.....	597,900	29.9	30.0	6,339	6,318	4,779	
21,756	....	.....	.....	8,000	134,939	6.7	7.0	9,742	9,324	3,874	
27,014	....	3,000	.....	2,000	153,388	7.7	9.0	4,555	3,897	4,720	
78,899	200	.....	.....	.....	283,918	14.2	13.0	5,488	5,994	4,673	
2,708	....	.....	.....	.....	9,478	0.5	1.0	2,708	1,354	.....	
130,377	200	3,000	.....	10,000	581,723	29.1	30.0	6,173	5,987	4,422	
18,188	200	.....	.....	2,000	87,129	4.4	6.0	9,788	7,178	6,603	
28,428	....	3,000	.....	.....	157,621	7.9	8.0	5,334	5,268	3,289	
81,469	200	.....	.....	.....	284,777	14.2	16.7	5,957	5,065	6,704	
1,762	....	.....	.....	.....	6,167	0.3	0.3	2,937	2,937	.....	
129,847	400	3,000	.....	2,000	535,694	26.8	31.0	6,368	5,505	5,532	
.....	....	.....	.....	.....	2,770,774	138.5	154.0	6,412	5,766	5,270	

TABLES—

DISTRICT No. 7—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent, Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
29	Asphalt	34,940	.....	.....	22,642	3,889	.....	2,945	No influence.	No influence.	1,710	200	.....	.....	.....	66,326	3.3	3.2	10,588	10,919	9,650	
	Granite	59,910	29,955	11,982	18,897	2,456	2,456	2,500			76,310	200	4,332	.....	.....	208,998	10.5	10.3	5,706	5,816	7,540	
	Belgian	55,730	33,438	22,292	22,612	6,945	3,402	2,967			55,730	....	2,599	.....	.....	205,715	10.3	9.5	5,411	5,866	7,407	
	Total	150,580	63,393	34,274	64,151	13,290	5,858	8,412	.....	.....	133,750	400	6,931	.....	.....	481,039	24.1	23.0	6,248	6,547	8,199	
31	Asphalt	48,970	.....	.....	23,695	2,667	1,333	2,667	No influence.	No influence.	.....	....	.....	.....	.....	79,332	4.0	5.0	12,242	9,794	9,513	
	Granite	74,670	37,335	13,921	31,254	3,611	2,600	4,911			34,800	200	6,063	.....	.....	209,365	10.5	11.0	7,111	6,788	7,066	
	Belgian	11,410	6,846	4,564	4,564	2,311	1,156	1,156			.....	....	.....	.....	.....	32,007	1.6	2.0	7,131	5,705	5,890	
	Total	135,050	44,181	18,485	59,513	8,589	5,089	8,734	.....	.....	34,800	200	6,063	.....	.....	320,704	16.1	18.0	8,388	7,503	7,490	
33	Asphalt	39,920	.....	.....	25,568	3,000	1,500	2,800	No influence.	No influence.	.....	....	.....	.....	.....	72,788	3.6	5.3	11,089	7,485	12,130	
	Granite	94,600	47,300	17,400	40,533	5,200	5,200	5,200			34,800	400	6,932	.....	.....	257,565	12.9	12.4	7,333	7,670	9,255	
	Belgian	20,580	12,348	8,232	8,232	2,600	1,300	1,300			.....	....	.....	.....	.....	54,592	2.7	3.3	7,622	6,174	10,117	
	Total	155,100	59,648	25,632	74,333	10,800	8,000	9,300	.....	.....	34,800	400	6,932	.....	.....	384,945	19.2	21.0	8,087	7,386	10,501	
35	Asphalt	40,760	.....	.....	19,488	2,333	1,167	2,066	No influence.	No influence.	.....	200	.....	.....	.....	66,014	3.3	4.2	12,351	9,591	13,690	
	Granite	98,430	49,215	18,068	44,796	4,960	4,834	4,849			23,200	....	6,063	.....	.....	254,415	12.7	11.3	7,435	8,750	21,057	
	Belgian	10,030	6,018	4,012	4,012	2,022	1,011	1,011			.....	....	.....	.....	.....	28,116	1.4	1.5	7,164	6,687	7,272	
	Total	149,220	55,233	22,080	68,296	9,315	7,012	7,926	.....	.....	23,200	200	6,063	.....	.....	348,545	17.4	17.0	8,576	8,778	10,673	
37	Asphalt	41,550	.....	.....	13,788	2,311	2,311	2,311	No influence.	No influence.	.....	....	.....	.....	13,335	75,606	3.8	5.0	10,934	8,228	11,194	
	Granite	79,270	39,635	14,001	40,135	4,622	4,622	4,622			2,800	200	6,932	.....	16,002	212,841	10.6	10.0	7,478	7,927	6,833	
	Belgian	17,620	10,572	7,048	7,048	2,311	1,156	1,156			.....	....	.....	.....	.....	46,911	2.3	2.7	7,661	6,407	8,243	
	Other (cobble)	1,330	3,990	532	1,064	.....	.....	.....			.....	....	.....	.....	.....	6,916	0.3	0.3	4,433	6,650	.....	
	Total	139,770	54,197	21,581	62,035	9,244	8,089	8,089	.....	.....	2,800	200	6,932	.....	29,337	342,274	17.0	18.0	8,222	7,765	8,757	
39	Asphalt	23,080	.....	.....	14,733	1,733	867	1,733	No influence.	No influence.	.....	....	.....	.....	8,001	50,147	2.5	3.0	9,232	7,693	11,077	
	Granite	60,280	30,140	11,594	24,486	3,467	3,467	3,467			21,000	....	5,199	.....	8,001	171,101	8.6	8.5	7,009	7,092	5,300	
	Belgian	20,790	12,474	8,316	8,316	1,733	867	867			.....	....	.....	.....	.....	53,363	2.7	3.0	7,700	6,930	.....	
	Other (cobble)	2,080	6,240	832	1,664	.....	.....	.....			.....	....	.....	.....	.....	10,816	0.5	0.5	4,160	4,160	.....	
	Total	106,230	48,854	20,742	49,199	6,933	5,201	6,067	.....	.....	21,000	....	5,199	.....	16,002	285,427	14.3	15.0	7,436	7,082	8,189	
41	Asphalt	58,570	.....	.....	28,212	2,802	1,711	2,733	No influence.	No influence.	.....	....	.....	.....	29,337	123,365	6.2	6.8	9,447	8,613	15,180	
	Granite	50,650	25,325	10,130	24,960	5,328	5,111	5,349			21,000	200	4,766	.....	18,669	171,488	8.6	7.0	5,890	7,236	5,207	
	Belgian	17,730	10,638	7,092	7,092	2,556	1,278	1,278			.....	....	.....	.....	.....	47,664	2.4	2.6	7,387	6,649	5,721	
	Other (cobble)	3,310	9,930	1,324	2,648	.....	.....	.....			.....	....	.....	.....	.....	17,212	0.9	0.6	3,680	6,206	.....	
	Total	130,260	45,893	18,546	62,912	10,686	8,100	9,360	.....	.....	21,000	200	4,766	.....	48,006	359,729	18.1	17.0	7,197	7,662	8,703	
	District total	966,210	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	2,522,663	126.1	129.0	7,662	7,490	9,767	

TABLES—

DISTRICT No. 8—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
32	Asphalt	63,480	.....	.....	29,072	2,035	.....	1,385	No influence.	.....	63,480	No influence because of University and College Settlements, Aids to the Department Street Cleaning, etc., etc.	6,000	.....	.....	165,452	8.3	9.0	7,650	7,053	.....	
	Granite	87,106	43,553	4,855	36,201	2,441	1,790	3,336		1,073	87,106		6,000	.....	.....	273,461	13.7	14.0	6,358	6,222	.....	
	Belgian	15,356	9,214	2,071	9,965	1,790	1,790	895		1,073	25,592		3,000	.....	.....	70,746	3.5	3.0	4,388	5,119	.....	
	Total	165,942	52,767	6,926	75,238	6,266	3,580	5,616	.....	2,146	176,178		15,000	.....	.....	509,659	25.5	26.0	6,508	6,382	.....	
34	Asphalt	37,623	.....	.....	19,742	3,084	2,056	3,084	No influence.	.....	37,671		3,000	.....	.....	106,260	5.3	6.0	7,099	6,271	.....	
	Granite	91,796	45,898	3,060	45,876	2,056	1,028	2,056		1,252	93,233		12,000	.....	.....	298,255	14.9	16.0	6,161	5,737	.....	
	Belgian	33,790	20,274	11,220	17,623	2,056	2,056	1,028		1,252	56,317		3,000	.....	.....	148,616	7.4	7.0	4,566	4,827	.....	
	Total	163,209	66,172	14,280	83,241	7,196	5,140	6,168	.....	2,504	187,221		18,000	.....	.....	553,131	27.7	29.0	5,892	5,628	.....	
36	Asphalt	42,542	.....	.....	34,034	5,400	2,322	3,600	No influence.	.....	42,000		3,000	4,500	.....	137,398	6.9	6.0	6,166	7,090	7,543	
	Granite	102,992	51,496	12,918	42,690	2,090	1,045	2,090		1,252	100,000		12,000	.....	.....	328,573	16.4	16.0	6,280	6,437	5,727	
	Belgian	65,512	39,307	18,795	19,512	2,090	2,090	1,045		1,252	69,187		3,000	.....	.....	221,790	11.1	10.0	5,902	6,551	6,615	
	Total	211,046	90,803	31,713	96,236	9,580	5,457	6,735	.....	2,504	211,187		18,000	4,500	.....	687,761	34.4	32.0	6,135	6,595	6,628	
38	Asphalt	22,195	.....	.....	13,731	2,094	1,047	1,047	No influence.	.....	20,000		3,000	.....	.....	63,114	3.2	3.0	6,936	7,398	.....	
	Granite	127,292	63,646	7,440	42,587	5,097	2,025	5,097		1,252	109,584		12,000	.....	.....	376,020	18.8	18.0	6,771	7,072	.....	
	Belgian	56,467	33,880	18,013	20,321	4,339	6,178	3,089		1,252	56,934		3,000	.....	.....	203,473	10.2	10.0	5,536	5,647	.....	
	Total	205,954	97,526	25,453	76,639	11,530	9,250	9,233	.....	2,504	186,518		18,000	.....	.....	642,607	32.1	31.0	6,416	6,644	.....	
40	Asphalt	22,881	.....	125	13,312	1,773	887	887	No influence.	.....	25,762		3,000	.....	.....	68,627	3.4	3.0	6,730	7,627	.....	
	Granite	92,003	46,001	20,241	31,245	1,131	1,131	2,018		1,073	94,006		5,500	.....	.....	294,349	14.7	15.0	6,259	6,134	.....	
	Belgian	16,056	9,634	5,100	9,623	1,773	1,773	887		1,073	27,112		.....	.....	.....	73,031	3.7	3.0	4,340	5,352	.....	
	Total	130,940	55,635	25,466	54,180	4,677	3,791	3,792	.....	2,146	146,880		8,500	.....	.....	436,007	21.8	21.0	6,006	6,235	.....	
	District total	877,091	.....	.....	.....	.....	.....	.....	.....	.....	.....		.....	.....	.....	2,829,165	141.5	139.0	6,199	6,310	6,628	

TABLES—

DISTRICT No. 9—

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.
45	Asphalt	27,590	.....	.....	7,897	1,060	1,060	1,060	.....	.....
	Granite	95,363	47,682	1,873	23,579	9,638	5,447	11,071	.....	.....
	Belgian	27,015	16,209	8,106	19,679	7,111	3,556	3,556	2,775	.....
	Total	149,968	63,891	9,979	51,155	17,809	10,063	15,687	2,775	.....
47	Asphalt	76,364	.....	.....	30,546	.....	.....	.....	9,500	.....
	Granite	64,245	32,122	12,849	23,586	.....	.....	.....	11,947	.....
	Belgian	41,810	25,086	9,157	33,448	6,740	1,808	5,279	3,000	2,277
	Total	182,419	57,208	22,006	87,580	6,740	1,808	5,279	24,447	2,277
49	Asphalt	19,550	.....	.....	10,540	.....	.....	.....	4,887	.....
	Granite	70,630	35,315	17,643	28,252	5,198	2,931	2,599	8,522	1,759
	Total	90,180	35,315	17,643	38,792	5,198	2,931	2,599	13,409	1,759
51	Asphalt	11,547	.....	.....	4,619	.....	.....	.....	2,887	.....
	Granite	59,155	29,577	12,380	13,706	2,856	2,856	1,428	3,075	1,713
	Total	70,702	29,577	12,380	18,325	2,856	2,856	1,428	5,962	1,713
52	Granite	40,533	20,267	4,866	16,213	2,744	1,444	2,022	.....	2,433
	Total	40,533	20,267	4,866	16,213	2,744	1,444	2,022	.....	2,433
53	Asphalt	36,622	.....	.....	.....	.....	.....	.....	.....	.....
	Granite	78,583	39,291	.....	31,433	5,250	5,250	2,625	.....	.....
	Total	115,205	39,291	.....	31,433	5,250	5,250	2,625	.....	.....
54	Asphalt	2,717	.....	.....	.....	.....	.....	.....	.....	.....
	Granite	117,738	58,869	.....	.....	11,222	11,222	5,611	.....	.....
	Total	120,455	58,869	.....	.....	11,222	11,222	5,611	.....	.....
	District total	769,462	.....	.....	.....	.....	.....	.....	.....	.....

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Difficulty Added by— Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
7,590	600	.....	.....	14,000	60,857	3.0	2.0	9,197	13,795	13,800	
35,363	400	2,500	.....	12,000	244,916	12.2	12.0	7,817	7,947	8,500	
17,015	....	.....	.....	.....	105,022	5.3	4.0	5,097	6,754	6,700	
59,968	1,000	2,500	.....	26,000	410,795	20.5	18.0	7,316	8,332	9,667	
.....	200	.....	.....	10,000	126,610	6.3	7.0	12,121	10,909	10,900	
.....	200	.....	3,000	16,000	163,949	8.2	9.0	7,835	7,138	7,150	
41,810	200	500	.....	8,000	179,115	9.0	6.0	4,646	6,968	7,000	
41,810	600	500	3,000	34,000	469,674	23.5	22.0	7,762	8,292	8,350	
.....	....	.....	.....	14,000	48,977	2.5	3.0	7,820	6,517	6,500	
71,260	200	.....	3,000	8,000	255,309	12.8	12.0	5,518	5,886	7,100	
71,260	200	.....	3,000	22,000	304,286	15.3	15.0	5,894	6,012	6,800	
.....	200	.....	.....	4,000	23,253	1.2	1.5	9,623	7,698	7,700	
59,155	....	.....	.....	28,000	213,901	10.6	9.5	5,581	6,227	7,900	
59,155	200	.....	.....	32,000	237,154	11.8	11.0	5,992	6,427	7,800	
20,533	....	.....	.....	40,000	151,055	7.5	7.0	5,404	5,790	8,100	
20,533	....	.....	.....	40,000	151,055	7.5	7.0	5,404	5,790	8,100	
.....	....	.....	.....	6,000	42,622	2.1	2.0	17,439	18,311	15,700	
.....	....	.....	.....	.....	162,432	8.1	8.0	9,702	9,823	15,700	
.....	....	.....	.....	6,000	205,054	10.2	10.0	11,295	11,521	15,700	
.....	....	.....	.....	.....	2,717	0.14	0.5	20,000	5,434	15,700	
.....	400	.....	.....	.....	205,062	10.3	9.5	11,431	12,393	15,700	
.....	400	.....	.....	.....	207,779	10.4	10.0	11,582	12,046	15,700	
.....	....	.....	.....	.....	1,985,797	99.2	93.0	7,757	8,274	9,529	

TABLES—

DISTRICT No. 10—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by— Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
42	Asphalt	14,013	.....	585	7,684	.....	.....	.....	.....	No influence.	28,026	....	.....	.....	8,665	58,973	3.0	2.0	4,671	7,007	8,709	
	Granite	117,266	58,633	24,151	41,967	4,773	3,080	4,107	3,080		116,532	200	3,500	.....	12,131	389,420	19.5	18.0	6,014	6,515	8,048	
	Belgian	12,133	7,280	4,853	9,706	4,107	4,107	2,053	.....		24,266	....	500	.....	.....	69,005	3.5	4.0	3,467	3,033	4,600	
	Total	143,412	65,913	29,589	59,357	8,880	7,187	6,160	3,080	.....	168,824	200	4,000	.....	20,796	517,398	26.0	24.0	5,516	5,975	7,119	
43	Asphalt	9,380	.....	.....	7,504	.....	.....	.....	.....	No influence.	15,630	....	.....	.....	1,733	34,247	1.7	2.0	5,520	4,690	6,134	
	Granite	131,613	65,806	35,097	41,781	6,300	5,403	6,300	2,640		114,226	200	3,000	.....	1,733	414,099	20.7	18.0	6,358	7,312	11,273	
	Belgian	18,266	10,959	7,306	11,530	3,587	3,587	1,794	.....		36,532	....	.....	.....	3,466	97,027	4.9	4.0	3,728	4,567	6,133	
	Total	159,259	76,765	42,403	60,815	9,887	8,990	8,094	2,640	.....	166,388	200	3,000	.....	6,932	545,373	27.3	24.0	5,834	6,636	7,847	
44	Asphalt	28,864	.....	.....	14,388	.....	.....	.....	.....	No influence.	45,728	200	.....	.....	6,932	96,112	4.8	4.0	6,013	7,216	6,647	
	Granite	65,333	32,667	1,913	30,116	5,310	4,719	5,311	1,760		52,666	200	4,000	4,500	12,131	220,626	11.0	9.0	5,940	7,259	7,580	
	Belgian	38,963	23,378	7,703	18,508	2,370	2,370	1,185	.....		77,926	....	.....	3,000	5,199	180,602	9.0	8.0	4,329	4,870	6,133	
	Total	133,160	56,045	9,616	63,012	7,680	7,089	6,496	1,760	.....	176,320	400	4,000	7,500	24,262	497,340	24.8	21.0	5,370	6,341	6,787	
46	Asphalt	30,915	.....	3,091	23,334	.....	.....	.....	.....	No influence.	10,915	200	.....	1,500	6,932	76,887	3.8	5.0	8,136	6,183	6,004	
	Granite	62,910	31,455	6,491	24,684	2,933	2,205	2,938	2,200		53,820	200	2,500	3,000	13,864	209,200	10.5	7.0	5,991	8,987	9,207	
	Belgian	48,603	29,162	7,291	22,961	2,933	2,933	1,467	.....		97,206	....	.....	.....	5,199	217,755	10.9	11.0	4,459	4,418	6,133	
	Total	142,428	60,617	16,873	70,979	5,866	5,138	4,405	2,200	.....	161,941	400	2,500	4,500	25,995	503,842	25.2	23.0	5,652	6,193	7,115	
48	Asphalt	13,268	.....	.....	9,598	.....	.....	.....	.....	No influence.	.....	....	.....	.....	5,334	28,200	1.4	3.0	9,477	4,423	5,062	
	Granite	54,950	27,475	2,747	24,287	2,933	2,205	2,938	2,200		37,000	200	2,500	3,000	2,667	166,002	8.3	7.0	6,620	7,850	6,647	
	Belgian	55,722	33,433	5,572	27,502	5,134	8,800	4,400	8,706		53,444	....	.....	.....	10,668	213,381	10.7	10.0	5,208	5,572	6,133	
	Total	123,940	60,908	8,319	61,387	8,067	11,005	7,338	10,906	.....	91,344	200	2,500	3,000	18,669	407,583	20.4	20.0	6,076	6,197	5,947	
50	Asphalt	49,686	.....	2,347	32,006	1,613	.....	1,613	.....	No influence	4,000	....	.....	.....	10,668	101,933	5.1	7.0	9,742	7,098	7,242	
	Granite	76,860	38,430	16,726	19,911	1,834	1,687	2,420	1,760		89,970	....	2,000	3,000	26,670	281,268	14.2	11.0	5,413	6,987	7,680	
	Belgian	39,935	23,961	13,528	15,974	6,608	3,744	3,304	.....		56,870	....	.....	.....	5,334	169,258	8.5	9.0	4,698	4,437	.....	
	Total	166,481	62,391	32,601	67,891	10,055	5,431	7,337	1,760	.....	150,840	....	2,000	3,000	42,672	552,459	27.6	27.0	6,032	6,166	7,461	
	District total	868,680	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	3,023,995	151.2	139.0	5,745	6,249	6,955	

TABLES—

DISTRICT No. 11—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

Section.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.	Remarks.
55	Asphalt	14,557	.....	.....	11,646	.....	.....	.....	Little trouble.	.....	.....	....	.....	.....	6,000	32,203	1.6	2.0	9,098	7,279	.....	The width and evenness of pavements in these sections allow the extensive use of machine sweepers, which save much labor of the hand broom.
	Granite	146,777	73,389	9,960	68,305	8,834	4,445	8,834		.....	80,800	600	.....	.....	48,000	449,944	22.5	13.0	6,523	11,291	.....	
	Belgian	110,532	66,319	19,616	60,000	.....	.....	.....		.....	.....	....	.....	.....	36,000	292,467	14.6	10.0	7,571	11,053	.....	
	Total	271,866	139,708	29,576	139,951	8,834	4,445	8,834	.....	.....	80,800	600	.....	.....	90,000	774,614	38.7	25.0	7,025	10,875	.....	
56	Asphalt	9,869	.....	.....	3,948	.....	.....	.....	Little trouble.	.....	.....	....	.....	.....	4,000	17,817	0.9	1.0	10,966	9,869	.....	
	Granite	156,943	78,471	10,348	60,922	3,222	3,222	3,222		1,832	182,943	400	.....	.....	52,000	553,525	27.7	20.0	5,666	7,847	.....	
	Belgian	68,449	41,069	3,629	25,126	.....	.....	.....		.....	68,449	400	.....	.....	22,000	229,122	11.5	8.0	5,952	8,556	.....	
	Total	235,261	119,540	13,977	89,996	3,222	3,222	3,222	.....	1,832	251,392	800	.....	.....	78,000	800,464	40.1	29.0	5,867	8,113	.....	
57	Granite	99,949	49,974	3,386	38,000	3,111	2,111	3,111	Little trouble.	1,812	.....	200	.....	.....	34,000	235,654	11.8	17.0	8,445	5,879	.....	This section being the northeastern limit of the city, the paved streets are so far apart that much of the sweepers' time is used in reaching the successive parts of their work.
	Belgian	30,398	18,239	5,020	11,359	556	2,222	556		.....	.....	....	.....	.....	14,000	82,350	4.1	6.0	7,414	5,066	.....	
	Total	130,347	68,213	8,406	49,359	3,667	4,333	3,667	.....	1,812	.....	200	.....	.....	48,000	318,004	15.9	23.0	8,198	5,667	.....	
58	Granite	229,664	114,832	862	80,266	3,945	3,945	3,945	Little trouble.	4,301	.....	600	.....	.....	80,000	522,360	26.1	25.5	8,799	9,006	.....	
	Belgian	24,653	14,792	8,575	9,861	4,500	18,000	4,500		.....	.....	....	.....	.....	10,000	94,881	4.7	9.0	5,246	2,739	.....	
	Other (brick)	22,612	.....	.....	.....	.....	.....	.....		.....	.....	....	.....	.....	6,000	28,612	1.5	1.5	15,075	15,075	.....	
	Total	276,929	129,624	9,437	90,127	8,445	21,945	8,445	.....	4,301	.....	600	.....	.....	96,000	645,853	32.3	36.0	8,574	7,693	.....	
	District total	914,403	.....	.....	.....	.....	.....	.....	.....	.....	.....	....	.....	.....	.....	2,538,935	127.0	113.0	7,200	8,092	.....	

TABLES—

SERIES No. 3—(*Continued*).

SUMMARY BY DISTRICTS—

EQUIVALENTS.

District.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. Tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.	Difficulty Added by— Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Add 25 per Cent. for Day Sweeping.	Final Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper. Calculated.	Employed.	In Sweeping Test of One Week.
1	Asphalt	39,728	.....	5,554	59,592	389	195	195	Little trouble	.....	27,528	....	.....	18,000	.....	151,181	37,795	188,976	9.4	8.0	4,226	4,966	7,373
	Granite	480,061	240,032	4,296	712,647	50,258	26,968	27,523		6,849	281,331	800	31,500	250,500	.....	2,112,765	528,191	2,640,956	132.0	133.0	3,637	3,609	5,337
	Belgian	13,347	8,009	660	20,020	389	195	195		.....	6,696	....	.....	6,000	.....	55,511	13,878	69,389	3.5	3.0	3,814	4,449	2,899
	Total	533,136	248,041	10,510	792,259	51,036	27,358	27,913	.....	6,849	315,555	800	31,500	274,500	.....	2,319,457	579,864	2,899,321	144.9	144.0	3,680	3,702	5,203
2	Asphalt	247,233	.....	.....	309,684	13,749	4,306	12,264	.....	1,286	504,103	Vastly improved, because of paper cans, etc.	34,500	115,500	.....	1,242,625	.....	.....	62.1	67.0	3,981	3,690	2,930
	Granite	538,798	269,399	31,081	685,150	52,224	37,720	58,931	No trouble	1,688	880,701		7,500	.....	.....	2,563,192	.....	.....	128.1	128.3	4,206	4,199	2,102
	Belgian	70,402	42,242	11,189	86,300	12,501	5,418	12,562		987	123,535		.....	.....	.....	365,136	.....	.....	18.3	18.7	3,847	3,765	....
	Other (cobble)	8,847	26,541	3,539	12,500	375	416	320		.....	16,847		.....	.....	.....	69,385	.....	.....	3.4	4.0	2,602	2,212	....
	Total	865,280	338,182	45,809	1,093,634	78,849	47,860	84,077	.....	3,961	1,525,186	....	42,000	115,500	.....	4,240,338	.....	.....	212.0	218.0	4,082	3,969	2,516
3	Asphalt	142,879	.....	1,353	162,328	4,039	1,834	4,671	.....	.....	78,784	800	.....	1,500	.....	398,188	.....	.....	19.9	20.2	7,180	7,056	6,580
	Granite	563,233	281,617	108,698	439,668	82,297	12,528	82,521	No influence	2,860	430,902	3,000	2,000	48,000	.....	2,057,324	.....	.....	102.9	100.5	5,474	5,604	5,578
	Belgian	170,987	102,592	65,964	105,963	8,386	8,526	6,695		4,290	172,465	200	.....	.....	.....	646,068	.....	.....	32.3	29.8	5,294	5,747	6,322
	Other (brick)	1,150	.....	.....	920	.....	.....	.....		.....	.....	....	.....	.....	.....	2,070	.....	.....	0.1	0.5	11,500	2,300	....
	Total	878,249	384,209	176,015	708,879	94,722	22,888	93,887	.....	7,150	682,151	4,000	2,000	49,500	.....	3,103,650	.....	.....	155.2	151.0	5,658	5,816	6,160
4	Asphalt	217,508	.....	9,519	263,818	12,569	2,032	12,154	.....	1,907	214,147	1,000	.....	3,000	.....	737,654	.....	.....	36.9	39.0	5,900	5,577	8,091
	Granite	372,454	186,227	47,091	464,346	45,715	17,159	46,411	18,869	7,106	364,760	1,400	.....	7,500	.....	1,579,038	.....	.....	79.0	79.9	4,712	4,662	5,528
	Belgian	175,830	105,498	25,102	160,981	16,288	12,131	9,487	.....	.....	197,272	1,600	.....	4,500	.....	708,689	.....	.....	35.4	32.9	4,967	5,344	5,864
	Other (cobble and wood)	4,784	11,322	1,510	808	600	600	300	.....	.....	.....	....	.....	.....	.....	19,924	.....	.....	1.0	1.2	4,784	3,987	....
	Total	770,576	303,047	83,222	889,953	75,172	31,922	68,352	18,869	9,013	776,179	4,000	.....	15,000	.....	3,045,305	.....	.....	152.3	153.0	5,060	5,036	6,494
5	Asphalt	164,685	.....	10,005	90,595	13,098	19,453	23,013	.....	.....	186,685	800	19,000	.....	.....	527,364	.....	.....	26.4	29.9	6,238	5,508	7,285
	Granite	378,374	189,187	87,369	237,065	60,596	37,868	48,947	.....	.....	479,783	800	18,000	.....	4,500	1,542,489	.....	.....	77.1	76.0	4,908	4,979	6,093
	Belgian	445,701	267,420	152,232	232,966	27,151	25,636	28,270	20,800	9,153	466,879	1,400	22,000	.....	.....	1,699,608	.....	.....	85.0	82.0	5,244	5,435	7,183
	Other (cobble)	5,700	17,100	2,280	.....	.....	.....	.....	.....	.....	10,600	....	.....	.....	.....	35,680	.....	.....	1.8	2.1	3,167	2,714	....
	Total	994,460	473,707	251,886	560,626	100,845	82,957	100,260	20,800	9,153	1,143,947	3,000	59,000	.....	4,500	3,805,141	.....	.....	190.3	190.0	5,225	5,234	6,854

TABLES—

SUMMARY BY DISTRICTS—

SERIES No. 3—(*Continued*).

EQUIVALENTS.

District.	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of: Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Track.	Condition of Pavement bet. tracks.	Sanding of Track.	Association Sprinkling.	Elevated Railroad.
6	Asphalt	286,942	.....	9,116	105,577	12,673	.....	13,747	1,250	.....
	Granite	176,908	88,454	14,292	253,393	15,017	5,395	14,482	.....	8,280
	Belgian	418,502	251,101	107,633	220,597	20,496	15,660	16,688	1,250	7,958
	Other (cobble)	5,645	16,935	1,458	4,516	.....	.....	.....	.....	.....
	Total	887,997	356,490	132,499	584,083	48,186	21,055	44,917	2,500	16,238
7	Asphalt	287,799	.....	.....	148,126	18,735	8,889	17,255	No influence.	No influence.
	Granite	517,810	258,905	97,096	225,061	29,644	28,290	30,898		
	Belgian	153,890	92,334	61,556	61,876	20,478	10,170	9,735		
	Other (cobble)	6,720	20,160	2,688	5,376	.....	.....	.....		
	Total	966,210	371,399	161,340	440,439	68,857	47,349	57,888	.. ..	.....
8	Asphalt	188,721	.....	125	109,891	14,386	6,312	10,003	No influence.	.....
	Granite	501,189	250,594	48,514	198,599	12,815	7,019	14,597		5,902
	Belgian	187,181	112,309	55,199	77,044	12,048	13,887	6,944	.....	5,902
	Total	877,091	362,903	103,838	385,534	39,249	27,218	31,544	.....	11,804
9	Asphalt	174,390	.....	.....	53,602	1,060	1,060	1,060	17,274	.....
	Granite	526,247	263,123	49,611	136,769	36,908	29,150	25,356	23,544	5,905
	Belgian	68,825	41,295	17,263	53,127	13,851	5,364	8,835	5,775	2,277
	Total	769,462	304,418	66,874	243,498	51,819	35,574	35,251	46,593	8,182
10	Asphalt	146,126	.....	6,023	94,514	1,613	.....	1,613	.....	No influence.
	Granite	508,932	254,466	87,125	182,746	24,083	19,299	24,014	13,640	
	Belgian	213,622	128,173	46,253	106,181	24,739	25,541	14,203	8,706	
	Total	868,680	382,639	139,401	383,441	50,435	44,840	39,830	22,346	.....
11	Asphalt	24,426	.....	.....	15,594	.....	.....	.....	.....	.....
	Granite	633,333	316,666	24,556	247,493	19,112	13,723	19,112	Little trouble.	7,945
	Belgian	234,032	140,419	36,840	106,346	5,056	20,222	5,056		.....
	Other (brick)	22,612	.....	.....	.....	.....	.....	.....		.....
	Total	914,403	457,085	61,396	369,433	24,168	33,945	24,168	.....	7,945

District.	Kind of Pavement.	Difficulty Added by—: Character of Population.	Schools.	Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.	Equivalent Total.	Add 25 per Cent. for Day Sweeping.	Final Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper: Calculated.	Employed.	In Sweeping Test of One Week.
6	Asphalt	111,008	800	.....	.....	10,000	551,113	.....	.....	27.5	31.0	10,434	9,256	5,894
	Granite	120,782	....	15,000	.....	2,000	714,003	.....	.....	35.7	46.5	4,956	3,804	3,885
	Belgian	406,577	1,000	.....	.....	.....	1,467,462	.....	.....	73.4	73.7	5,550	5,679	6,031
	Other (cobble)	9,642	....	.....	.....	.....	38,196	.....	.....	1.9	2.8	2,971	2,016	....
	Total	648,009	1,800	15,000	.....	12,000	2,770,774	.....	.....	138.5	154.0	6,412	5,766	5,270
7	Asphalt	1,710	400	.....	.....	50,673	533,578	.....	.....	26.7	32.5	10,779	8,855	12,240
	Granite	213,910	1,200	40,287	.....	42,672	1,485,773	.....	.....	74.3	70.5	6,969	7,345	9,250
	Belgian	55,730	....	2,599	.....	.....	468,368	.....	.....	23.4	24.6	6,577	6,256	7,810
	Other (cobble)	.....	....	.....	.....	.....	34,944	.....	.....	1.7	1.4	3,953	4,228	....
	Total	271,350	1,600	42,886	.....	93,345	2,522,663	.....	.....	126.1	129.0	7,662	7,490	9,767
8	Asphalt	188,913	Improved because of paper cans, etc.	18,000	4,500	.....	540,851	.....	.....	27.1	27.0	6,964	6,990	7,543
	Granite	483,929		47,500	.....	.....	1,570,658	.....	.....	78.5	79.0	6,384	6,344	5,727
	Belgian	235,142		12,000	.....	.....	717,656	.....	.....	35.9	33.0	5,214	5,672	6,615
	Total	907,984		77,500	4,500	.....	2,829,165	.....	.....	141.5	139.0	6,199	6,310	6,628
9	Asphalt	7,590	1,000	.....	.....	48,000	305,036	.....	.....	15.2	16.0	11,473	10,900	11,717
	Granite	186,311	1,200	2,500	6,000	104,000	1,396,624	.....	.....	69.8	67.0	7,539	7,854	10,021
	Belgian	58,825	200	500	.....	8,000	284,137	.....	.....	14.2	10.0	4,847	6,883	6,850
	Total	252,726	2,400	3,000	6,000	160,000	1,985,797	.....	.....	99.2	93.0	7,757	8,274	9,529
10	Asphalt	104,299	400	.....	1,500	40,264	396,352	.....	.....	19.8	23.0	7,380	6,353	6,633
	Granite	465,114	1,000	17,500	13,500	69,196	1,680,615	.....	.....	84.0	70.0	6,059	7,270	8,406
	Belgian	346,244	....	500	3,000	29,866	947,028	.....	.....	47.4	46.0	4,507	4,644	5,826
	Total	915,657	1,400	18,000	18,000	139,326	3,023,995	.....	.....	151.2	139.0	5,745	6,249	6,955
11	Asphalt	.....	....	.....	.....	10,000	50,020	.....	.....	2.5	3.0	9,770	8,142	....
	Granite	263,743	1,800	.....	.....	214,000	1,761,483	.....	.....	88.1	75.5	7,189	8,388	....
	Belgian	68,449	400	.....	.....	82,000	698,820	.....	.....	34.9	33.0	6,706	7,092	....
	Other (brick)	.....	....	.....	.....	6,000	28,612	.....	.....	1.5	1.5	15,075	15,075	....
	Total	332,192	2,200	.....	.....	312,000	2,538,935	.....	.....	127.0	113.0	7,200	8,092	....

TABLES—SERIES No. 3—(*Continued*).

CITY SUMMARY—EQUIVALENTS.

	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of Difficulty Added by—									
			Kind of Pavement.	Condition of Pavement.	Amount of Traffic.	Car Tracks.			Association Sprinkling.	Elevated Railroad.	Character of Population.	Schools.
						Presence of Rails.	Condition Pavement bet. Tracks.	Sanding of Track.				
City.....	Asphalt..	1,920,428	.....	41,695	1,413,321	92,311	44,081	96,005	18,524	3,193	1,424,767	5,200
	Granite.....	5,197,339	2,598,670	599,729	3,782,937	428,669	235,119	392,792	56,053	46,535	4,171,266	11,200
	Belgian.....	2,152,319	1,291,392	579,891	1,231,401	161,383	142,750	118,670	36,531	30,567	2,137,814	4,800
	Other.....	55,458	92,058	11,475	24,120	975	1,016	620	.....	.....	37,089	.....
	Total.....	9,325,544	3,982,120	1,232,790	6,451,779	683,338	422,966	608,087	111,108	80,295	7,770,936	21,200
Sweepers necessary because of		466.3	199.1	61.6	322.6	34.2	21.1	30.4	5.6	4.0	388.5	1.1

	Kind of Pavement.	Area, Square Yards.	Equivalent, in Square Yards, of Difficulty Added by—			Equivalent Total.	Add 25 Per Cent. of District No. 1.	Final Equivalent Total.	Sweepers Necessary, Calculated.	Sweepers Employed.	Square Yards Kept Clean per Sweeper.		
			Produce and Market Stores.	Push-cart Trade.	Vicinity of Unpaved Streets.						Calculated.	Employed.	In Sweeping Test of One Week.
City...	Asphalt ...	1,920,428	71,500	144,000	158,937	5,433,962	37,795	5,471,757	273.6	296.65	7,019	6,474	7,201
	Granite ...	5,197,339	181,787	325,500	436,368	18,463,964	528,191	18,992,155	949.6	926.2	5,473	5,612	5,821
	Belgian....	2,152,319	37,599	13,500	119,866	8,058,483	13,878	8,072,361	403.6	386.65	5,333	5,566	6,156
	Other	55,458	.....	.....	6,000	228,811	.....	228,811	11.4	13.5	4,865	4,108	....
	Total.	9,325,544	290,886	483,000	721,171	32,185,220	579,864	32,765,084	1,638.2	1,623.0	5,693	5,746	6,393
Sweepers necessary because of.....		466 3	14.5	24.1	36.1	.....	28.9	1,638.2	.....	.....	....	....	....

AREA OF STREETS CLEANED.

The table herewith exhibits the result of actual measurements of streets cleaned, made by District Superintendents and Foremen, in the autumn of 1897. The figures are derived from detailed reports made for each section, street by street, which are now on file in the Department:

District.	Area Square Yards Asphalt.	Area Square Yards Granite.	Area Square Yards Belgian.	Area Square Yards Cobble.	Area Square Yards Brick.	Area Square Yards Wood.	Area Square Yards Total.	Amount Sweepings Daily, Bags.	Remarks.
No. 1.....	43,029 1/9	487,718 2/3	14,178 2/9	1,396 3/9	.....	.....	546,322 3/9	3,981 5/8	
No. 2.....	281,433.63	511,061.72	48,591.77	9,331.43	783.33	.....	851,201.88	4,460	
No. 3.....	223,388	606,069	113,721	2,800	1,480	.....	947,858	2,302 3/4	Added in, mixed, 400.
No. 4.....	294,868.08	310,750.97	218,999.76	4,571.97	.....	1,126.80	830,317.58	2,684	
No. 5.....	304,576 4/9	381,791 5/9	2,946.14	3,200	.....	.....	984,182	2,662 1/2	
No. 6.....	348,140.14	236,622.73	269,994.10	4,054.30	.....	.....	858,811.27	1,835	
No. 7.....	353,699	515,070	124,831	4,300	299	.....	998,199	1,538 1/2	Omitted. Unpaved, 14,944.
No. 8.....	292,140	386,726.2	219,726.4	7,988.3	.....	.....	906,580.9	1,503 1/4	
No. 9.....	305,099 4/9	492,388	73,125	200	.....	.....	770,835 7/9	1,095 1/8	Added in, flagging, 23 1/3.
No. 10.....	202,633 4/9	430,506 1/9	209,236 1/9	.....	.....	226 3/9	858,592 2/3	1,297	Added in, macadam, 15,960 2/3.
No. 11.....	100,387 4/9	842,957 5/9	94,379 3/9	322	24,332 7/9	.....	1,062,379	2,015 3/8	
Totals....	2,649,424.74	5,201,652.40	1,681,396.70	38,164.34	26,895.11	1,353.13	*9,615,280.42	†25,375 1/8	

* Equal to 546.3 miles of paved streets 30 feet wide.

† At 35 bags per cart-load, we have 686 cart-loads per day.

THE PROBLEM OF SNOW REMOVAL.

DEPARTMENT OF STREET CLEANING,
NEW YORK, May 1, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—The following historical sketch and report relates to the work done in snow and ice removal under the various Commissioners from the year 1881, when the Department of Street Cleaning was taken from the control of the Police Department and became a separate branch of the city government, to the 15th of January, 1895, comparing the results achieved with those since that date under the present administration. The data for the comparison have been very carefully and exhaustively compiled from the various reports in the "City Record," and checked with the voucher books and records in the Department archives. In the few instances of difference between the sources of information the latter authority has been uniformly chosen.

NECESSITY FOR REMOVAL.

The question of snow removal has always been one of the most vexatious problems confronting the various administrations. The removal of "new fallen snow from leading thoroughfares and such other streets and avenues as may be found practicable" is a duty made obligatory upon the Commissioner by law, and, with each year, the moral obligation to the vast traffic interests of congested Manhattan Island becomes more insistent. Of late also the question of the health of the community has entered with great force into any consideration of the subject. With the crowding of the immense tenement population into that human bee-hive, the East Side, there has been an actual bulging out from the houses to the now clean asphalt streets. Whether it be winter or summer the people must have this additional room opened up for them, and a delay in the removal of the almost knee-deep snow and befouled slush is at the cost of much sickness, and, probably, many lives each winter.

APPROPRIATIONS.

With such an uncertain quantity to estimate upon as the yearly snowfall, the annual appropriations for this important part of the Department's work have been nominal sums of $25,000 or $40,000. Be-

tween the years 1882 and 1892 the annual expenditure was never more than $45,000 and averaged nearly within the $25,000 allowed. In the past three years, with the enormous increase in the amounts of snow removed, there has necessarily been a much larger annual expenditure. Any sums needed for additional necessary removal beyond the yearly appropriation are transferred from other Department accounts by vote of the Board of Estimate and Apportionment, and are returned by the sale of revenue bonds.

REMOVAL PRIOR TO 1895.

In the small amounts of snow removed each winter up to January, 1895, the work was performed mainly with the regular Department force, hiring additional laborers and carts when the fall was a heavy one.

The quantity of street area opened to traffic by this method was necessarily insignificant and was centred in a small portion of the down-town districts. Here nearly all the sweepers from the various sections throughout the entire city were concentrated into piling and loading gangs, and the Department carts in use in the hauling of ashes and garbage during the day were sent, with fresh horses and drivers, to the snow district for the night duty which constituted nearly all the work. This obviously meant a serious interruption to the regular Department duties; the important work of keeping the crosswalks, gutters and sewer culverts open and free was inadequately performed by the few sweepers left in each section, and the collection of ashes and garbage was made exceedingly difficult and oftentimes stopped, with the result that the refuse was dumped by the householders into the nearest snow bank and left for "spring cleaning" when the snow had melted off. In some instances, and in one year especially, the storms came so rapidly that the Department force had scarcely finished one before the work on another began, with the result that the large part of the Department in use on snow removal duty was nearly exhausted with the almost continuous strain, and the regular routine work was not fairly resumed until spring.

REMOVAL IN 1895.

In the early months of 1895 the removal by day's work was continued, but, for the first time, each of the eleven Districts did its own work and its head was made responsible for the hiring of most of the additional carts and laborers required in the District. In this, the first year of the present administration, the work was extended materially and the mileage of streets cleared increased in all parts of the city with the securing of many more hired carts than were ever used before. Very much more day-work also was done than in previous years.

REMOVAL IN 1896 AND 1897.

In the autumn of 1895-'96 the first proposal for the removal of snow and ice by contract was advertised for, and the contract let to the only bidder, Herbert Tate, Esq., at 56 cents per cubic yard. No snow was removed under this agreement until after the first of the year 1896.

With the beginning of 1896 came a new era. Quantities hitherto undreamed of were removed in every storm and the mileage of cleared streets increased enormously. The work was done by the contractor in the manner and at the places indicated by the Commissioner, and a temporary bureau was organized each winter and placed in entire charge of the burdensome details that had so long hampered the regular Department work. A system, made necessary by the letting of the contract in cubic yards, was evolved of inspectors at the loading and dumping places to tally the loads and to protect the city's interests. No more was the snow taken from unimportant side streets, where no work was being performed, and dumped in other streets only a few blocks away, but all cartmen had to get their loads from the regular working places and dump them into the river before receiving the token of the city's indebtedness. Best of all the Department was relieved entirely of the care and labor incident to the hiring of carts and men, keeping their time and making up pay-rolls, and the vexatious delays in payment of the emergency forces formerly needed in the removal of snow, which delays were so potent a factor in causing the hiring of enough extra carts to become with each year a more difficult matter, were obviated altogether, and the contractor, by paying both cartmen and shovelers promptly after each storm, made possible the removal of the present extraordinary and constantly increasing daily totals. The Department laborers were retained in their own sections upon the necessary crosswalk and gutter work, and the interruptions to the regular Department routine were reduced to a minimum. Snow removal became a matter of dollars and cents. Given a certain amount of money, so many cubic yards could be removed, and, in consequence, so much territory could be opened up according to the depth of the fall. Much better results were secured (by the contractor paying by the load) from the limited supply of vehicles at the disposal of New York City in any snowstorm. The drivers, instead of hauling eight or ten loads for a day's work and then leaving, as formerly, worked continuously and as rapidly as their horses could be made to move in the endeavor to get in as many loads, and therefore secure as much money as they could.

EXPLANATION OF BASIS OF COMPARISON—TABLES.

In the autumn of 1896 there were three bidders for the contract for the season of 1896-'97, and it was let to G. M. Furman, Esq., for 42 cents per cubic yard. It will be seen from the table below that the

amount of snow removed under this contract is considerably more than twice the totals for each of the two previous winters.

The table shows, for every winter, the official snowfall in inches, the number of loads removed by the Department forces and by the respective contractors, the totals for each winter, with cost and the cost per load. (A load of snow is taken as one and one-half cubic yards). The second column comprises the day's work of the Department in every winter, and in addition the removal by Contractor Tate for '95-'96, and by Contractor Furman for '96-'97. The third column shows the amounts removed by the contractors, who, from 1882 to 1888, inclusive, had entire charge of the street cleaning work below Fourteenth street, and were compelled by their contract to cart away snow without extra cost to the city. In the fourth column, likewise, is given, wherever they could be separated, the number of loads removed each winter, after that of 1885-'86, by Holland & Co., who cart away all the snow on Broadway from Bowling Green to Park place for the Metropolitan Street Railway Co. without expense to the city. The company's charter requires an equivalent removal on its tracks from the Battery to Fourteenth street, and the work is confined to this particular locality—the contractors clearing away the snow from curb to curb—to avoid a confusion of responsibility.

Neither of these columns, then, the third and fourth, although included in the totals by winters, enters into the costs of removal, which are made up solely from the bills presented for the work done by Department forces and Contractors Tate and Furman, as shown in the second column. These costs, also, are all exclusive of supervision by the Department inspectors, foremen and superintendents.

TABLE.

Winters.	Snow-fall in Inches.	Loads by Day's Work, Department Forces and Contractors Tate and Furman.	Loads by the Contractors below Fourteenth St.	Loads by Holland & Co., Lower Broadway.	Totals.	Total Cost per Winter.	Cost per Load.
1881–1882....	....	*23,174	.....	.....	*23,174	*$22,551 24	*$.973
1882–1883....	....	18,475	17,927	.....	36,402	15,360 04	.831
1883–1884....	....	40,709	30,124	.....	70,833	27,352 05	.672
1884–1885 ..	36.6	22,313	18,195	.....	40,508	20,213 22	.906
1885-1886....	23 9	21,578	26,807	.....	48,385	15,035 24	.697
1886–1887....	49.5	30,973	32,203	1,332	64,508	24,429 53	.789
1887–1888....	47.4	51,894	18,320	5,886	76,100	47,474 40	.915
1888–1889....	21.9	4,010	No snow was hauled by these contractors after 1887–1888.	1,086	5,096	5,985 22	1.493
1889–1890...	34.1	36,359		402	36,761	29,555 82	.813
1890–1891....	39.5	64,132		.....	64,132	56,405 53	.880
1891–1892....	36.5	27,052		.....	27,052	23,094 28	.854
1892–1893....	77.6	86 213		.....	86,213	62,458 78	.724
1893–1894....	56.1	105,669		.....	105,669	60,691 51	.574
1894–1895, up to Jan. 15..	11.4	64,074		1,260	65,334	42,498 93	.663
1894–95, after Jan 15.....	24.8	261,884		1,825	263,709	183,225 64	.700
1895–1896....	42.0	271,265		1,980	273,245	254,716 65	.939
1896–1897....	39.1	700,263		2,726	702,989	445,038 59	.636

* These figures are the only ones found in the *City Record*, but the total in loads is 5,137 less than the number given in Commissioner Coleman's Review of the Operations of the Department, published in 1889.

It will be noted that, in the above table, the winter of 1894-'95 is divided into two portions—the one before January 15, 1895, and the other after that date. In the summary of the table, these portions, for the sake of convenience, are each called a half of a winter. The summary is shown below, and is a comparison of the period from 1881 to 1895 under previous Commissioners with that of the present administration since its inauguration on January 15, 1895. It gives the totals by day's work and by contract and the entire amounts of snow re-

moved for the periods mentioned. The average number of loads for a winter in each period, with their comparative percentages, the total cost of removal and the average cost per cartload are also shown.

SUMMARY.

Periods.	Loads by Day's Work, Department Forces and Contractors Tate and Furman.	Loads by Contractors below 14th Street and on Lower B'way.	Total Number of Loads for Entire Period.	Average Per Winter in Loads.	Relative Percentage of Averages by Winters.	Total Cost of Removal.	Average Cost Per Load.
From Winter 1881–1882 to Jan. 15, 1895, equals 13½ Winters.....	596,625	153,542	750,167	55,568	11.2%	$453,105 79	$.759
Jan. 15, 1895, to Spring, 1897, equals 2½ Winters.....	1,233,412	6,531	1,239,943	495,977	100%	882,980 88	.716

COMPARISON OF TOTAL AMOUNTS AND COSTS.

It will be seen from this summary that the amount of snow removed in the two complete winters, '95-'96, and '96-'97, and in the portion of '94-'95, with the Department, under the direction of the present Commissioner, is 1,239,943 loads (1½ cubic yards each), almost twice the entire amount removed in the thirteen full winters and the portion of another, before the 15th of January, 1895. The average per winter for the present administration is 495,977 loads, against 55,568 loads for the winters preceding, or only 11.2 per cent. of the present amount each winter was removed in the winters prior to 1894-'95. The total cost of removal under all the former Commissioners is $453,105.79, or an average cost per load removed of $0.759; under the present administration it has been $882,980.88, or an average cost per load of $0.716. This is over four cents lower than the average for all the previous administrations, and would be much smaller were it not for the fact that the first contract price, 56 cents per cubic yard, or 84 cents per load, was high—only one contractor risking an entirely untried and venturesome experiment even at that figure. Another reason for the increased cost in 1895-'96 is that, in that winter, the wages of the large sweeping force engaged in the cleaning of crosswalks, opening of gutters, etc., were charged to the Snow and Ice account. This has not been done in 1896-'97. The low price of $0.636 for the winter just passed will undoubtedly be even diminished in the winter of 1897-'98, as the competition promises to prove sharp, so that it is safe to predict a cost per load of considerably less than 60 cents. As long as the contract system is continued, this price will tend to grow smaller, as new competitors are secured and improved methods developed.

Another and most important point that should be borne in mind in the consideration of any question of cost is the well known fact that the standard of the size of loads set in the years 1895, 1896 and 1897 is far more severe than was ever attempted under other administrations. Not only are the former small and often "dummy" loads no longer to be seen, but during the past winter, at least, the carts have, in almost every instance, been heaped up beyond the absolutely required capacity. The saving to the city in this one item alone by fearless and honest inspectors will, each year, prove a sum of no inconsiderable proportions.

COMPARISON OF AMOUNT BY STORMS.

As showing most markedly the great increase in the amount of snow removed, the following paragraph from the report of Commissioner Coleman for 1888 is subjoined:

"A snow-storm of unequalled severity broke over this city on "March 12, 1888. By reason of its intensity and violence it is popu- "larly known and referred to as the 'Blizzard.' The amount of the "snowfall was unprecedented, being, according to official figures, 22 "inches, and threatened to affect the business of the city to an alarm- "ing extent. To meet this emergency the physical and financial re- "sources of this Department were fully tested. The appropriation for "the removal of snow and ice for the whole year was only $25,000, "and the greater part of that sum had already been expended for work "done in January and February. But this Department made no delay "in addressing itself to the great task which so unexpectedly con- "fronted it, and worked so rapidly that the threatened blockade of the "streets and stoppage of business were soon averted. Traffic in the "commercial districts, which had been temporarily suspended, was "speedily resumed, and before the expiration of one week almost all "traces of the memorable snow-storm had been practically effaced "from the streets."

The total amount of snow actually removed during the work on this huge storm, as given by the same report, is 40,542 loads. This includes the amount removed with the Department forces by day's work, the amount removed by the contractors below Fourteenth street, and the amount carted away by the contractor hauling for the Metropolitan Street Railway Company on lower Broadway.

In *every* storm of the past winter there has been removed well over 200,000 loads, and on one day alone 55,773 loads were hauled, exclusive of railroad work and the lower Broadway contract. This is 15,000 more than the total for the entire week's work on the "Blizzard." An average of the ten largest days' work for the winter of 1896-'97 gives 40,534 loads—or as much snow, within eight loads, was hauled on each of these ten days as was removed during all the work upon the famous storm of 1888.

COMPARATIVE MILEAGE—MAP OF 1881-1895.

A comparison of the mileage of streets cleared per storm is also of interest. The accompanying map of the city shows the streets, in full black, cleared during the work upon an average storm in the period preceding this administration. The mileage is 22.80—a fair, if not too large average for the storms of varying depths and under different Commissioners. There are, so far as can be ascertained, absolutely no records in the Department of the streets cleared in any one storm or under any especial Commissioner, but those shown on this map have been most carefully compiled from every available source, partly with the aid of old schedules and maps of the work planned for each winter, but chiefly through the courtesy and assistance of the two General Superintendents under Commissioners Beattie, Brennan and Andrews. The total comprises more streets than could be ascertained from any one authority, and includes nearly everything given in them all. I feel firmly convinced of its fairness as far as one can be in considering a compilation from uncertain and indefinite data, and, where any one street is found omitted for a certain storm, many more will be seen that were not touched at all during that especial work. The mileage of 22.80 is less than 16 per cent. of that for the average storm of the present time.

MAP OF PRESENT PERIOD.

The second map here given shows the streets (marked in full black as before) cleared in the storm from February 12 to February 16, inclusive, 1897. As will be at once observed, virtually all the street area below Houston street receives attention. About one-half of the streets between Houston and Fifty-ninth streets are cleared of snow, and above Fifty-ninth street only the main traffic thoroughfares and some of the crowded tenement streets are taken. The designation of the streets and avenues will be readily found by the numbers on the outside of the map. The mileage of this storm is 144.416, one and one-half miles less than the average for the winter—the snowfalls in which were all unusually heavy.

A very marked difference between the two maps will be noticed in looking at the congested tenement district east of the Bowery and south of Houston street. This was never touched formerly, while now it is virtually entirely cleared in every storm. Other very noticeable differences will show themselves upon even casual inspection.

COST OF CLEARING ENTIRE CITY—DIFFICULTIES.

The average mileage of streets cleared in the storms in the winter of 1896-'97, exclusive of street railway work, is less than one-third of the city's total mileage of paved streets, and is practically all the area absolutely necessary to have cleared. Purely residence and unimportant side streets neither receive nor require attention, an expenditure

for their clearing not being justified by the demands of the city as a whole. If it were desired to remove the snow from every street in the city, each storm would cost per inch of snow, as computed from the records of the season of 1896-'97, $51,041.60. Thus with the 10-inch falls of the season just passed, the cost, exclusive of any items except the sums actually paid to the contractor at his price per cubic yard, would be, for each storm, $510,416. This is on the basis of the present mileage (433) of paved streets in the city, and would make the cost aggregate, for even an ordinary winter, $1,500,000.

Even were the money forthcoming it would be practically impossible to clear the entire street area of the city within a reasonable time on account of the limited supply of vehicles available for the purpose of snow-hauling. In February of the past winter the unprecedented number of 4,000 vehicles of all kinds was reached on the day of the heaviest work, an increase of at least 1,500 over any day in 1895-'96. Nearly all the increase, however, was represented by merchandise wagons, rack trucks and by other vehicles not stern dumping, whose usefulness beyond a certain point is limited by their slowness in unloading and clumsiness at the dumps.

GROWING LACK OF DUMPING FACILITIES.

Even if the carting supply could be increased to any great extent the dumping facilities would be lacking. At present every available pier and bulkhead on both rivers, from the Battery to Fourteenth street, is in use in every storm, and they are all blocked for short or long periods during each day. The serious shortage in the supply of snow dumps has only been felt in the past few years, with the great increase in the amount of snow disposed of, and is caused by the unwillingness on the part of business men leasing piers and bulkheads from the city to allow this Department to use these facilities for snow dumping purposes. It is certain that if the list of leased dumps refused to us continues to grow larger at its present rate, the city will be forced to take the matter up and make some arrangement with the Dock Department by which all leases shall have inserted in them a clause compelling the permitting of snow dumping at any and all times of the actual work upon a storm, with the proviso that any permanent lessening of the depth of water in a slip through such dumping be made good at the city's expense, by dredging each spring. Snow, in the traffic streets of a big city, becomes mixed with dirt by contact, by absorption and in a thousand and one different ways almost as soon as it falls. It is impossible in practice to remove only clean snow, and the amount of dirt increases in every instance with the length of time elapsing before the street is reached in the schedule of work. It is sheer nonsense, therefore, to look upon the removal of a certain quantity of dirt with all city snow as other than an accepted fact and one to be made the best of.

MELTING MACHINES.

With the scarcity of carting and dumping facilities, as depicted above, it is not too much to venture the opinion that the city will in the future hardly get beyond the daily records of the past winter unless new methods of removal are developed. Of these the most promising is by melting. Machines for this purpose have been tried in various cities in the Union for a number of years back, and have, in every instance, proved failures in actual practice. The Department has experimented with a variety of makes and has found none with any great promise until this winter, when one, which has been in use in every storm, has shown the possession of a fair amount of efficiency and a cost of operation considerably lower than the contract price of removal by carts. It remains to be seen whether this machine will stand the brunt of hard usage in narrow car-track streets with heavy traffic, and in connection with the numerous other difficulties in the way of snow removal under all the conditions of work in the busiest city in America. It is hoped, however, that, with a little further development and more practical experience, this type of machine may in the future be made a valuable adjunct to the limited supply of carts now at our command.

STREET RAILWAY WORK.

A most important feature of the snow work under this administration has been the agreements made with the street railways. Under an opinion from the Counsel to the Corporation the Commissioner of Street Cleaning has been authorized to enter into agreements with the various street railways in the city for the amount of snow removal to be performed by them in lieu of that required under the provisions of section 271, chapter VIII., Revised Ordinances. This ordinance demands, upon the part of the companies, that they cart away all snow thrown off their tracks by their plows or sweeping machines. A definite arrangement has been made with all the companies—each assuming the entire responsibility for a certain fixed street area, from curb to curb, instead of only on its tracks, while the city clears the snow from as much of the remainder of the streets, through which the company's tracks pass, as is deemed practicable and necessary.

During the past winter the corporations have all lived up to their agreements, and the assistance they are rendering the city must prove a source of deep gratification to all citizens who have long noted, with regret, the desultory and unsatisfactory work performed by the railways in previous years. In every instance the agreements have been entered into upon the part of the companies with a most cordial spirit of co-operation and apparent desire to perform the share of snow-removal exacted of them by the ordinance. The total mileage of streets, from curb to curb, cleared by the railways is a trifle over eleven in each storm, representing a saving to the city the past winter alone of $35,598.53, something hitherto unheard of. It is of interest to note that

this sum is greater, by over $3,000, than the entire average annual expenditure of the Department for snow removal in the years from 1882 to 1894, inclusive.

ASSISTANCE TO OTHER CITY DEPARTMENTS.

I would bring to your attention, in this connection, the work done by this Department for the other branches of the city government, noticeably the Fire Department and Board of Education. With the former, many of the blocks containing engine-houses or hook and ladder stations have, for the first time in the history of the city, been cleared of the snow after each storm, or a passageway plowed to the nearest cleared avenues in either direction for the purpose of facilitating the quick handling of these heavy and cumbersome vehicles. It is proposed next winter to extend this work and to allow as much as possible in lieu of removal by carting, which would be a heavy and unnecessary expense in the unimportant side streets in which the Fire Department has most of its stations.

Many of the blocks throughout the city containing school-houses have been cleared of snow the past winter, and it is proposed next year to include practically all of these blocks that are paved. This will promptly open to the children their normal playground. Prior to this administration nothing was ever done in either of these directions.

NEWSPAPERS STORIES, DECEMBER, 1896.

It may be well in closing to speak of the stories circulated by a few irresponsible newspapers, of dishonesty in the work of snow removal in the early part of last winter. In December, 1896, the Department, through its system of checks and inspection, discovered and arrested a man attempting to buy up the city's token of indebtedness. Certain newspapers, with no knowledge of the facts, made grossly exaggerated claims of immense frauds perpetrated upon the city. A thorough investigation was held and it was found that, as the collusion of three persons was necessary to carry out a fraud successfully, not more than $300 had been lost to the city by dishonesty in the handling of the Department's vouchers. Wherever the items to this total were discovered the sums were deducted from the payments made to the contractor, and the one or two Department employees implicated were dismissed.

After the December storm nothing more was attempted in the way of fraudulent transactions, and the inspectors and detectives detailed for the purpose of preventing collusion discovered not a sign of suspicion against even the humblest of the Department laborers necessarily employed in places of responsibility. With a total expenditure for the winter of approximately $440,000, the trivial loss above instanced is of note only as showing the absolute honesty of the great mass of Department subordinates and the efficiency of the system of checks and

counterchecks which prevents the operations of those of the men disposed to do evil.

The following papers relate to certain elements of the subject of snow removal which will be interesting to those who may care to study the systems employed from time to time:

DETAILS AS TO THE WINTER OF 1894-'95.

HIRING LABORERS THROUGH PADRONES.

Before the inauguration of the present system of removal by contract the procedure was, as already explained, to hire extra carts and laborers by the day, to assist the regular Department force. Permission had first to be obtained from the Mayor, under the three days' emergency clause, to hire such additional help, and it had to be renewed at the expiration of every three days. Before the winter of 1894-'95 the hiring of these emergency laborers was done indirectly through certain bosses or "padrones," controlling a large number of men each. The padrone received from the city $1.50 per day for each laborer furnished, and retained from this sum a small percentage as compensation for his own services. He paid his men daily upon the completion of their work, although the city's payment in wages was never received by him until some time after each storm. No matter how sudden the call for laborers they were furnished at once and in any number desired. Moreover, they were all picked men, young and robust and accustomed to the heaviest manual labor. They were chosen without reference to their citizenship.

CHAPTER 368, LAWS OF 1894.

Strong pressure was brought to bear upon the State Legislature of 1894 by the labor unions of this city, and (on April 26) chapter 368 of the Laws of 1894 was passed, amending section 705 of the Consolidation Act so that any extra laborers thereafter to be employed by the Department of Street Cleaning in the removal of snow, as well as in the regular Department work, were to be American citizens and residents of the city. They were to be paid not less than $2.00 for eight hours' work and were to be chosen only from an eligible list of men passing a certain physical examination (consisting merely in securing a limited amount of data for purposes of description).

Thus the opening of the winter of 1894-'95 saw the padrone system done away with, an increase of one-third in the wages to be paid for labor, and the initiation of a complicated and burdensome piece of machinery for the hiring and paying of the emergency forces. Under the new conditions, Commissioner Andrews, up to the 15th of January, 1895, removed 65,334 loads of snow.

THE BEGINNING OF THE PRESENT ADMINISTRATION.

The first two storms after the 15th of January were less than two inches in depth and were followed by warm weather. The Department forces and their hired helpers worked rapidly, but very much more snow melted off than was removed. Despite this patent fact a vast amount of unintelligent praise and undeserved encomiums hailed the Commissioner's first efforts in the direction of snow removal. These thoughtless pæans of the press were changed into equally hasty and unfounded criticisms after the storm of February 7th and 8th—a fall of 5½ inches, which was followed almost immediately by an unusually severe and prolonged period of cold weather. The snow obstinately remained on the streets, and the Department worked continuously for fourteen days in the effort to cope with the conditions. During that time 128.59 miles of streets in different sections of the city were cleared, as against 22.80, the mileage for an average storm under former administrations.

This total of 128.59 miles was less than one-third the city's entire mileage of paved streets at that time, and the residents on the untouched two-thirds in their disappointment at not seeing the whole city promptly cleared in every storm, as they had hoped would be the case under the new Commissioner, began to intimate strongly that very little snow was being removed from any portion of the city. The Commissioner answered this most effectually with figures showing the mileage of streets cleared and the number of loads carted from those streets. He gave also an estimate (based upon careful computations from complete data), of the cost of clearing every street below Forty-second street as $1,000,000 for each winter, or $2,000,000 for the clearing of the whole street area of Manhattan Island.

The newspapers of the time were full of computations by public officials, engineers and private citizens, and the people of New York at last began to get an intelligent comprehension of what it really meant to clear of snow all the streets of the great city without appreciable assistance from the weather. It was seen that the problem was one peculiar to New York by reason of its situation, climate, heavy snowfall and immense street traffic, and that, in the hands of honest and capable officials, it could be narrowed down to the simple question of how much work the taxpayers really wanted done, how many streets opened, and, in natural sequence, how much money spent.

The deeply rooted conviction that has so long possessed the minds of all classes that, in some unexplained manner, snow, even in its imposing array of millions of cubic yards for the street area of a great city, could be removed for little or no money, gave way slowly, and, in some instances, was replaced with the equally strong belief in the entire practicability of methods other than the costly one of carting. The Department was deluged with suggestions ranging from the flushing of the streets (with the thermometer hovering about zero!) to the use of

melting machines. A number of experiments were conducted with different appliances, but only two—the one with a naphtha melting machine and the other with a steam pit—held out any hopes of even moderate value. In the latter, a trial concrete vault, 8 x 2 x 5 ft., with a steam pipe at the bottom, kept covered always with a foot of water, and with an outlet connection to the nearest sewer, was constructed on Franklin street. Steam was supplied by means of an ordinary boiler mounted on a four-wheel truck alongside the pit. The experiments were a practical failure—the snow shoveled into the pit melting very slowly, and the pit soon becoming choked with dirt.

RESULTS ACCOMPLISHED BY THE NEW ADMINISTRATION.

As regards the record of the Department under the new administration, it more than held its own in the eyes of every fair-minded citizen when figures were adduced showing that the various Commissioners during the five *years*, beginning with 1889, had removed 221,569 loads of snow at a total cost of $178,737.34, while there were removed in the five *weeks* under the new direction, 253,481 loads at a cost of $173,839.20. In this short time, then, more snow was removed at less expense than in the entire five years prior to the present administration, notwithstanding the fact that the Department had to pay $2.00 per day for labor where former Commissioners secured theirs for $1.50.

DISADVANTAGES OF THE SYSTEM IN OPERATION.

Despite the increased efficiency of the Department, the Commissioner saw, very early in the winter, the disadvantages under which he was laboring, and how much more could be accomplished if he were allowed to use the ordinary business methods applicable to the conduct of any large enterprise. To this end he advocated most strenuously the abolition of the citizenship requirement and the introduction of the contract system, by which the best laborers in the market could be secured at the prevailing rate of wages. The popular mind, while not so occupied with the business side of the problem, was, with each successive storm, more and more convinced of the unbearable but unavoidable hardships to the laboring men themselves of the system then, for the first time, in operation.

REGISTRATION OF EXTRA MEN.

In the beginning of the winter the physical examination of the extra men and their registration on the eligible list were conducted at the main office of the Department in the New Criminal Court Building. In the case of a snowfall the entire body of eligibles reported there also, and the steps, entrances and corridors were filled almost daily with a horde of unruly and not too clean laborers. This state of affairs became even more intolerable when the men were being paid,

and the judges, lawyers and attachés of the courts found it almost impossible to make their way through the fighting and cursing mob.

At first the new administration made a change by keeping the men outside, where they were obliged to wait for hours at a time in the cold or wet, but finally the entire operation of registering, hiring and paying these emergency forces was transferred to the different stables, and particularly to the large one at the foot of East Seventeenth street —Stable "A."

DRAWBACKS OF ENFORCED REGISTRATION.

One of the worst faults of the registration system, as applied to the emergency work of snow removal, was found in the fact that the men delayed their examination until the time of being hired, and, in consequence, the securing of a sufficient number of men with the rapidity desired was often rendered impracticable by the necessity for a proper registration and physical examination. Moreover, it was impossible in nearly every storm to obtain enough able bodied shovelers among the limited number of citizens applying for work. This difficulty was enhanced by the delays in paying which became apparent in the latter part of January.

DESCRIPTION OF OPERATIONS—SNOW REMOVAL BY DAY'S WORK.

In hiring the extra shovelers, they were picked out in squads of ten or twelve, and one of the most intelligent looking of their number selected as foreman and timekeeper, and placed in charge. These squads were sent out from the various stables to work at piling and loading at certain points designated by the General Superintendent of the Department through the District Superintendents under him. Carts were hired and a certain number sent (usually from the main office) to each Department foreman for use at the indicated points. The work was done almost entirely at night, and therefore the Department carts on returning from their regular day duties were furnished with hired horses and manned with drivers selected from the emergency men and placed with the hired carts under the various foremen. After the present Commissioner took charge of the Department the removal of snow in the day time was greatly extended and the results more than made up for occasional inconvenience to traffic. Eight or ten loads for both Department and hired carts were considered a night's work, gauged by the distance from the dump. The hired carts were paid for at the rate of $3.50 per night, and the Department carts cost $2.00 for the driver, besides the expense of the hired horse. The loads were tallied by the Department foremen in charge of each gang of carts as they left for the dump, and, after the night's work was completed, a dump sheet, showing the loads hauled in every case, was prepared by this official and forwarded to the main office.

The extra foremen in charge of the shovelers also sent to the main office daily the time of the men under them. From these two records

the pay-rolls were made up and forwarded to the Comptroller, in whose office they were subjected to minute and protracted scrutiny. Thence they went to the Paymaster, who fixed the time of payment. With even the regular Department employees it takes six days for the rolls to be made ready for payment, and with the horde of emergency snow forces it would normally take nearly twice as long. This time, however, was increased to three and even four weeks by the following circumstances:

CAUSES OF DELAY IN PAY-ROLLS.

In the first place the pay-roll force, as the Commissioner found it, was careless and incompetent, and mistakes even in addition were repeatedly discovered at the Comptroller's office, and the rolls returned for correction. The pay-roll force was, in any case, totally inadequate to cope with the great amount of extra work entailed by the new system, and their number was supplemented by as many men as could be spared from other duties. Every clerk on this work labored diligently from early in the morning often until midnight, and all day on Sundays and holidays.

Another cause for the delays was the discovery on some of the pay-rolls of the names of men living in Jersey City and Brooklyn. The Comptroller held back the payments on these rolls until an opinion from the Counsel to the Corporation was rendered declaring that carts might be hired from points outside New York City, but that non-resident shovelers could not legally be paid. The amount, less than $100, due these innocent offenders, was made up by several public spirited citizens.

CONFUSION IN KEEPING LABORERS' TIME.

The records received from the extra foremen in charge of the shoveling gangs were, however, the most potent factor underlying all the confusion and loss of time. These men were, in most cases, absolutely unknown to the officers of the Department. They received only fifty cents a day more than the laborers they were supposed to control, and were equally irresponsible. The ignorance and incompetency of some were as bad as the gross dishonesty of others. In many instances whole gangs were given no time on account of the foreman deserting during the night. Books were lost or were never sent to the main office, and, in many of those received, the names and addresses were unintelligible, ar the time of one man was confounded with that of another, so that some were paid too much and others too little. The task of straightening out this almost inextricable tangle fell to the lot of the pay-roll clerks, and the delay resulting may easily be understood.

But worst of all was the fact that frauds were perpetrated by the foremen in crediting time for work never done. Gangs of twelve men would leave a stable in charge of the extra foreman. Some of the laborers would desert after a few minutes' work, and those remaining

accomplished hardly as much as three men under honest supervision. All the gang, however, would be given full time by the rascally foreman. It was impossible to check this dishonesty to any considerable extent by the few Department officials available. The regular foremen were all needed with the carts, and the District Superintendents had the general work of a large territory to look after. It was the fault of the new system that it compelled the Department to exercise supervision over an unruly force of emergency laborers without enough regular officials for that purpose. Timekeepers had to be secured even though the applicants available were known to be incapable.

DISHONESTY IN TALLYING LOADS.

The dump sheets from the Department foremen were acceptable enough as regards intelligibility, but there was found to be rife among many of these subordinate officers a deplorable laxness in moral standards as applied to municipal work—a direct legacy from former administrations and the result of the deep-seated and long entertained conviction that strict integrity was not to be found or even expected in city employees. This opinion was aptly voiced in one newspaper by a pessimistic editorial, stating that frauds of this character would continue in the Department even with angels as watchers, and that—"Reform..... can't be had in New York streets without a terrific tussle with human nature of a very tough variety."

The Department foreman in charge of a gang of carts was supposed to register the number of each and to keep a correct tally of the loads hauled, until the required eight or ten were reached, when the drivers were allowed to go home and credited with a full night's work. In the hurry of the emergency the tally was improperly kept even with some of the honest foremen. With the connivance of the dishonest men some carts were registered under different numbers in as many as three or four separate gangs and paid for a full night in each. Lazy drivers, by intimidation or other means, were permitted to leave after hauling a few loads, and were credited with the full number. A newspaper of the time instanced one case happening on the 3d of February where a foreman was supposed to have twelve carts at the beginning of the evening. He really had but ten, and, of these, two carried six loads each, the others averaged four or five, and one removed only three loads.

Besides giving credit for loads that were never hauled, most of the cartmen were allowed to go to the dumps with carts insufficiently filled and often with only half loads. There was no one stationed at the piers used for dumping, and after the drivers once left the loading place, there was no check upon their actions, beyond the ordinary prevention of wrongdoing by police officers. Many instances occurred of men never going to the dump, but, instead, unloading their snow on a side street a short distance away, and waiting in the friendly shelter

of a saloon until it was time to return for another load. The drivers on the Department carts were a tough lot, and followed to the letter the lead set them by the men driving hired carts.

The numerous frauds mentioned were as apparent to the officials of the Department as to outsiders, but they could do nothing beyond dismissing the subordinates against whom dishonesty was proved and watching those under suspicion as closely as possible. Little could be done so late in the winter to remedy these conditions, and all energies were directed to the preparing of a better system for the following autumn.

MOBS AT THE CITY HALL.

As the delays in the paying of the extra men became long drawn out, scenes of disorder were of daily occurrence at the New Criminal Court Building. Crowds of hungry and ill-clad men besieged the main office of the Department seeking for information as to the time of payment. Not satisfied with the explanations they received, deputations marched to the City Hall and sent in committees to wait upon the Mayor, and to set forth their grievances. Five times were visits thus made, and the press was filled with the wails of the unpaid men and their friends. The Commissioner was appealed to on all sides by kind-hearted people, who appreciated the grievous want of the unpaid men, and it seemed to be the general impression that the Department alone was to blame for a condition thrust upon it against the most vigorous protests. The labor unions even went so far as to allege that the Commissioner was deliberately withholding the payments and causing all the intense distress in order to bring into public disfavor the act passed the previous spring and for which they stood sponsor.

DISORDER ATTENDING PAY-DAY AT STABLE "A."

At Stable "A," where most of the laborers were paid, there were scenes of the greatest disorder on February 14th, when the January work was settled for. For days before, the stable had resounded with the clamoring of the men for information as to when they would be paid. No one was able to tell them, except indefinitely, and the poor fellows were forced to come day after day from their homes in various parts of the city for fear that they might miss the payment.

When the date was finally announced, the streets in the neighborhood of the stable were thronged with a howling, disorderly mob. All was chaos, and the police reserves called upon for assistance were powerless to do more than prevent open outbreaks. Inside the stable the men were lined up in something like order, but only a few were admitted at a time, and the great mass were obliged to remain all day in the inclement weather outside. There were 5,028 names of shovelers on the rolls, and it was soon seen that all could not possibly be paid in the one day.

The procedure was to call out the name of the gang foreman, who would then gather about him the men who had worked under him and force his way through the mob to the door. A man in the crowd might see a gang in which he had worked making its way inside, but would be obliged to give up the attempt to reach his fellows after an ineffectual struggle. Many of the laborers had worked in as many as five different gangs, and their names appeared on as many separate pay-rolls. When one of these men was paid he would have to take his place in the cursing, fighting crowd outside and wait until the name of another one of his foremen was called.

The foremen stood by their men at the pay window and were supposed to identify them. As a matter of fact, the most honest frankly acknowledged that they could not remember the faces of men under them for so short a time, and many acquiesced in the identification of every man who gave any name and address appearing on their books. There were repeated instances where men assumed the names of their fellows and drew their pay, the real owners appearing only to find that no money could be given them. Several of the gangs had no pay-rolls at all, the foremen neglecting to send in their time. As the hour grew late the doors of the stable were burst in by the disappointed and frantic mob, and the police were obliged to use their clubs to clear the stable and to restore a semblance of order.

SECURING PAY ORDERS AT MAIN OFFICE.

At the main office down-town all the men who, for one reason or another, had not received their money at the stables, gathered after each pay-day in order to make their claims and to procure orders from the Department upon the City Paymaster. The scenes attending the confusion of paying off were repeated on a smaller scale, but with the added bitterness which many of the laborers felt when they found their wages had already been paid to other men, or that there was no evidence to substantiate their claims. Complaints again arose from the other occupants of the building, and, although the laborers were kept outside on Centre street and permitted to enter only in single file, they did all in their power to make everybody else as unhappy as themselves. The delay in paying may be fully appreciated when it is stated that some of these orders were issued as late as July 11, 1895, and that a few men ultimately never came for their wages, the money due them being turned back into the City Treasury.

COMPARISON WITH CONTRACT SYSTEM.

The Commissioner, in a communication at the time, summarized the whole deplorable situation in the statement that the delay in paying "lay entirely at the door of organized labor," and he showed how much better off the men would be under the contract system, with their somewhat smaller daily wage paid immediately. At the time he wrote

many of the shovelers worked only one day, earning $2.00, and the average of the last four days of the January storm was only $3.26. For this pittance the 5,028 men who had earned it had to stand around in the cold or wet, day after day, to get their money. Counting the time spent in coming for their pay, these innocent victims of an iniquitous law earned not more than fifty cents per day. Instead of receiving fifty cents per day *more* than their services were worth in the open market, they actually earned only one-third of their old wages. In other words, the Department appeared, as compared with a probable contractor, in the light of an unwieldy concern, whose cumbersome machinery and necessary red tape caused its temporary employees to work "fewer hours than either they or the City desired, and, not only to receive far less money, but to be compelled to wait for it."

The difference was most decidedly exemplified during the past winter (1896-'97), when, under the contract system, three times the number of shovelers used in '94-'95 were given work and paid daily if they desired it. There has been a total absence of the distress, confusion and disorder attendant upon the snow work of two winters ago, and the contractor, not being bound by complicated municipal procedure, may conduct his work in a business-like manner that appeals to every citizen.

A WINTER OF HARD WORK.

Despite all the disadvantages under which the Department labored during the memorable winter of 1894-'95, the amount of work done was unprecedented up to that time. Snow removal was conducted on over forty days during the winter, and, on thirty-nine of these, extra men and carts were hired. Although an average of 953 shovelers was used each day, the force was not sufficient for the needs of the work, and great difficulty was found in securing laborers on account of the citizenship requirement and the delays in paying. Carts were also exceedingly hard to hire by reason of the latter drawback, and the Department carts were forced to do most of the work. But even with these grave disadvantages there were hauled on the day of largest work (Jan. 31, '95), 22,808 loads, against 7,640 for the largest twenty-four hours' (Dec. 29, '94) record of the preceding administration. The Department subordinates worked night and day almost continuously, and the really wonderful results achieved were, in a great measure, due to the ceaseless efforts of Mr. William Robbins, who has been for many years the General Superintendent of the Department.

To one who remarks the ease with which over 50,000 loads of snow are now removed daily under the contract system, it is remarkable to look back upon the strain under which all officials, from the highest to the lowest, passed the entire winter only two years ago. From the 18th of January to, and including, the 21st of February, the work of snow removal was prosecuted with but the intermission of seven days when no outside work was done. The District Superin-

tendents and Section Foremen worked on snow removal during the night and until three or four o'clock in the morning, and then reported, bright and early the next day, for the regular work of removing ashes and garbage, the supervision of sweepers, etc. This unceasing toil was kept up day after day, and even the clerical force, as already stated, worked twice its usual hours. Certain it is that, since the relief afforded by the contract system, the Department will never again see such a severe and long continued strain, and, in the future, most of its officials, as was the case during the winter just passed, will be left free to attend to the routine work normally heavy in every winter.

METHOD OF SNOW REMOVAL UNDER THE CONTRACT SYSTEM.

A general idea of the method of snow removal under the contract system may be obtained from the following brief summary of the course of operations as conducted during the past winter ('96-'97):

DEPARTMENT ORGANIZATION.

Before the proposal has been advertised for and the contract let to the lowest responsible bidder, the work of organization is begun. An officer of the Department, with the title of Snow Inspector, is charged with this duty, and he, together with a fairly large office force and staff of assistants, is kept on nothing but snow work for the rest of the winter. A majority of the subordinate officers of the Department, during the actual work of removal of every snowfall, are assigned to duty in each District under the leadership of the District Superintendents.

Each District is made a separate and distinct basis of operations, and the District Superintendent is the unit of the active organization. He is the authorized representative of the Snow Inspector, and has absolute authority over the contractor's employees as to designating the points at which the work must be prosecuted and the number of shovelers and carts to be placed at those points. He is directly responsible to the Snow Inspector for the removal of the snow in his own District, in the manner prescribed by his daily instructions from the Snow Office, and with as much rapidity and success as is possible with the men and carts at his command.

The District Superintendent and his immediate subordinates are on the work only as long as the actual removal in their District lasts, which period ranges from three to seven days, according to the amount of clearing to be done in the District and the depth of the snowfall. In no case are they required to work night and day continuously, the ordinary tour of duty being from twelve to fourteen hours in length, and the routine work of the Department being carried on in the various sections by the officers left in each for that purpose.

CONTRACTOR'S ORGANIZATION.

The contractor is given office room with the Snow Inspector and his staff, and thus both organizations are in constant touch. The contractor's force is organized by following the indicated lines of division into Districts, with both day and night shifts. Night work is conducted only below Fourteenth street, and the results secured are not nearly as good as the day work in even that busy portion of the city.

CUBIC YARD AS BASIS OF CONTRACT.

It should be borne in mind that the snow contract is one for removal at a fixed price per cubic yard, and that the Department designates the streets to be cleared, as well as the manner and time of clearing. It is not a contract per inch-mile, per snowfall or per area cleared, and it is to the contractor's interest, as well as to the city's to remove as much snow as possible and with the utmost speed.

The measurement in cubic yards is gauged by the number of loads dumped—the capacity of all vehicles in use being known to both the Department inspectors and contractor's employees. A one-ton coal cart is the standard of a single load and holds one and one-half cubic yards. Double, triple and even quadruple loads are given by the relative capacity of brick trunks, large furniture vans and the like. Where there is the slightest doubt as to capacity, the vehicle in question is always measured before going on the work.

BEGINNING OF WORK ON STORM.

In the event of a snowfall the contractor has ample time to get his immense organization in readiness for the Commissioner's order to begin removal. This, usually, is not given until the snow ceases, unless the storm is seen to be a large one.

When the order is received, operations are begun within a few hours in every District from the Battery to north of the Harlem river, and almost simultaneously in each. The contractor's trusted subordinates collect large numbers of the unemployed at certain fixed meeting places, and gangs are formed of pilers and shovelers. Owners of carts and wagons in any number have already been told at the beginning of the season where to report in the event of a snowstorm, and, at any time during the removal, a man with a vehicle of the required capacity is put to work immediately upon application. There are always more shovelers applying than can be given employment, but never enough carts.

SCHEDULE OF WORK—OPERATIONS AT THE LOADING AND DUMPING STATIONS.

The points at which the work is begun are fixed and the schedules remain the same for each storm. These points are chosen as far as possible with regard to their relative importance, but with due consid-

eration to the practical problems of keeping the gangs well separated, at equal distances from the river front, and in such positions that the hauling to the dumps may be fairly equalized according to the capacity of each.

At each loading place is a Department Foreman, who, after a cart has been loaded from the street in which the work is being conducted, and if the load is satisfactory in size, gives to the driver a coupon signifying that the snow has been taken under Department supervision. At the piers used as dumping points, the loaded carts move out to the extreme end along one side; the drivers dump their snow into the river over the string-pieces and submit to the inspection of Department subordinates, who see that the carts are entirely emptied, that no snow is dumped on the pier, and that no false loads are allowed for. The empty carts return down the pier in single file on the opposite side, passing a Department Foreman at the street end, who receives from the driver his loading coupon and hands to a representative of the contractor, standing by his side, an equivalent brass check, properly stamped and numbered, as a tally of the City's indebtedness. The driver then receives a voucher from the contractor's representative showing that a load of snow has been regularly hauled and dumped, and that pay for the same will be given upon presentation of the voucher at the contractor's main offices. This is negotiable, as is also the similar voucher for hours of labor performed, which is handed to each shoveler at the close of his day's work, and both are honored—to the bearer—upon demand, at any time afterwards.

The number of brass checks turned in each day by the various representatives of the contractor is credited to his account by the Snow Inspector, and constitutes the basis of the bills presented by him for cubic yards removed.

The above outline will serve to indicate general methods, and it is not necessary to describe the numberless details connected with the administration of the work, all of which, however, are felt very forcibly in the labor incident to the removal of over 75,000 cubic yards and the clearing of 30 miles of streets daily.

SEASON 1896-'97—DATES OF STORMS.

The 16th of December, 1896, was the signal for the first heavy working storm of the winter. The fall, by Weather Bureau reports, was 7.8 inches, and almost all the roof snow was deposited in the streets. Despite many drawbacks and the fact that the contractor, Mr. G. M. Furman, had only closed the contract a week before, a very satisfactory organization was quickly effected, and the hauling was soon heavy in all parts of the city. The operations on this storm were hardly completed, when, on the evening of December 22d, another fall of 4.8 inches occurred, and the work was continued up to and including

the 31st of the month. These two falls are counted as one storm in all the tables and computations for the season.

Work on what is called the second storm of the winter began January 28th, and was completed on February 3d. The official figures showed a fall of 10 inches, but there was not so much trouble with ice or very cold weather as in December storms.

The third and, what proved to be, the last heavy fall of the season, occurred on February 12th, and work was prosecuted up to the 16th of the month and finished on that date. The depth of this storm, by the official figures, was given as 6½ inches, but Mr. E. B. Dunn, the local weather observer, states that the gauging was equal to 10 inches of freshly fallen snow, the difference being caused by sleet packing the material into a compact mass. The storm was found as hard to grapple with as the January fall of 10 inches, but the improvement in both organizations (through the gain in experience) was demonstrated by the fact that as much snow, within a few thousand cubic yards, was removed in five days as took seven in the storm preceding.

CONTRACTOR AND HIS ORGANIZATION.

The work of the contractor's and Inspector's offices moved without friction all winter. Almost all of the contractor's responsible employees were connected, in one manner or another, with the Barber Asphalt Co., and were personally known to Mr. Furman or to his assistants. To have trusted subordinates in work of so temporary and uncertain a character was necessarily of immense advantage to the contractor. The excellent results attained were largely due to his efforts.

STRICTNESS OF INSPECTION.

After the first storm of the winter, for which the Department and the contractor were both unprepared, the system of inspection was practically perfect. The loading and dump foremen were exceedingly strict, and the loads hauled were much larger than ever before. The reports of the various inspectors and detectives were most encouraging, and not a suspicion of dishonesty attached itself to any of the transactions incident to the loading and dumping. The Comptroller's representative was given every facility in his inspections in all the Districts, and expressed the highest appreciation of the manner in which the city's interests were being guarded.

EXPERIMENTS CONDUCTED.

A number of experiments for the purpose of devising new methods, reducing costs, etc., were conducted during the winter. Plows and the Hudson river ice scrapers (for asphalt streets) were used freely wherever the results warranted. In heavy storms the plows serve to clear a passageway in the street until removal can be secured. The

scrapers are of most service in piling ahead of the loading gangs in light falls.

The attempts to use sweeping machines, with specially prepared brooms, proved unqualified failures, even when begun as soon as the snow commenced falling.

On Madison avenue, from Twenty-third to Forty-second street, the snow was scraped to the middle of the street and piled in long ridges, with an opening in the centre of each block for vehicles. It was then allowed to remain, with the hope that it would disappear through natural causes. It was found, however, that the alternate melting and freezing caused thin runnels of ice from the ridge to the curb on each side, which made the street almost impassable late in the afternoon and at night, and the Department was forced to cart away the snow.

On the Boulevard, from Fifty-ninth to One Hundred and Twelfth street, in the last two storms, the snow was not removed, but was pushed from the parkway in the centre to the curb on each side, and there piled into ridges. The street was thus opened to traffic promptly, and with very little expense. No ice formed as in the Madison avenue experiment, because the drainage was not across the cleared pavement. The only disadvantage of the method was perceived some time after each storm, when the snow had melted from all the neighboring streets and the Boulevard was left with a black, dirty ridge on either side for its entire length. This was remedied by scattering out.

In the last storm of the season the rapidity with which the Boulevard was opened up to bicycling and traffic by this method is deserving of mention. Although the snow did not cease falling until Friday night and the storm was a heavy one, by Sunday morning the entire length of this popular thoroughfare from Fifty-ninth street to One Hundred and Twelfth street was perfectly clean and dry, and was traversed by hundreds of bicycles and carriages.

On all the asphalt and some of the stone streets cleared, the contractor used the steel pan scrapers (for asphalt sweeping) behind his carts, scraping the thin, dirty residue into piles, which were afterwards removed. Their use was productive of a very thorough and speedy final clearing.

SNOW MELTING RESULTS.

Two types of snow melting machines were given careful trials during the past winter. Of these the one using coke as fuel proved unsatisfactory, but the naphtha-burning machine showed a fair efficiency in all three storms, and was able, in the last two, to clear a long city block in from eight to ten hours. The cost of running is given by the superintendent of the company controling the machine as $10.15 per hour, which, from the reports of the Department inspector in charge of the experiments, is believed to be a fair estimate. With some improvements added since the last storm, the company claims a cost of $8.00

or less per hour, and an efficiency of a cubic yard of snow per minute.

The actual average efficiency for the last two storms of the winter (the number of yards melted being gauged by the loads removed in carts from parallel streets), was a little over two-thirds of a cubic yard per minute. Granting, with the improvements proposed, an efficiency of one yard per minute, or sixty yards per hour, at a cost per hour (actual running expense only) of $10.00, the melting machine of this type would dispose of the snow at a cost per yard of 16⅔ cents. If a machine were run at this rate the complete 24 hours without a break-down, it would be equivalent to about 30 single carts working both day and night with a change of horses.

During the past winter the actual cost of carting, per yard (exclusive of the shoveling items—piling and loading), was 25 cents. This would probably be increased to 30 cents, including the omitted items and taking into account the expense of manning and caring for the dumps. Considering the items of supervision identical in both cases, the showing, therefore, is very much in favor of the machine.

LIMITS TO USE OF MACHINE.

But it must be remembered that this computation of the efficiency of the melting machine is based only on the *actual* running time, makes no allowance for break-downs, stoppages, etc., and includes neither the interest on first cost, nor the maintenance and depreciation. Most significant of all, it is based upon experiments under the most favorable conditions of mild weather, unobstructed and light-traffic streets, and concentration in one portion of the city. In actual practice the machines would have to be used on many of the narrow car-track streets in the busiest sections of the city; they would be subject to orders changing their location at will and without preliminary notice, and there would be, naturally enough, much lost time from accidents and from the removal of street-dirt residue.

In certain of the congested portions of the city it will never be practicable to remove snow by other means than by carting with light vehicles, quickly filled and easily moved, and, in general, it may be said that, while the melting machine, from the results of the past winter, seems to prove its right to be considered as an important factor in the work of snow removal as a whole, it is especially valuable only in wide, open streets at a distance from the dumps, and in places where it is difficult to induce carts to go. There are numerous such places in the city where most efficient and economical results could be secured from the use of a limited number of machines, preferably under control of the contractor bidding for the entire work of removal.

TABLE NO. I.

A number of tables, giving a summary of the winter's operations, are appended. The first shows the daily totals in cubic yards in all

three storms and serves as a basis of comparison of the work on the respective days of each. It will be seen that, in every case, the third day of the work shows the largest results and that each storm marks a perceptible daily increase over the preceding one, until finally the work was completed in five days against fourteen as at first, and with no very great diminution in the total number of cubic yards hauled.

The recapitulation at the bottom of this table shows the total number of cubic yards removed for the entire winter, and is compared with the number actually paid for as determined by the dumping and melting. The discrepancy of 340½ cubic yards is due to the fact that in this table (and in all those following) the figures are in cubic yards *hauled*, as given by the reports of the loading foremen. Not all the loads hauled were dumped into the river or the loading voucher used. The total of 1,035,422½ cubic yards represents only the snow actually removed by Contractor Furman and the melting machines, and does not include the loads hauled by Department carts. This total, at 42 cents per cubic yard, gives the entire cost for the *contracting* work of the winter as $434,877.45. Department supervision, equipment, etc., and the removal by Department employees is not included in this sum.

TABLES NOS. II., III. AND IV.

Table No. II. compares the work of the eleven Districts into which the city is divided by the Department of Street Cleaning. It shows, for each, the cubic yards removed and mileage cleared in the different storms, and is continued in Table No. III., which gives the total amounts in miles and cubic yards for the entire winter, with the average number of cubic yards removed per mile of street cleared in each District.

This last is interesting, but is of value only as showing the greater amounts removed per mile in the uptown Districts. The varying results can be accounted for by difference in width of streets, temperature, etc. In District No. 9, for example, the large figure obtained is due to the fact that almost all the work was on avenues and the broad cross-town thoroughfare, One Hundred and Twenty-fifth street. District No. 2 shows the smallest average per mile, a normal result for the many narrow streets in that portion of the city.

Table No. IV. is a division of all the mileage cleared in each storm into its component parts, and shows also the comparative work done by each street railway company.

TABLE NO. V.—CONTRACT BY INCH-MILE.

Table No. V. shows the cost per inch-mile of street cleared for each storm of the winter. It gives also the official depths of falls, the mean temperature for the entire period of work on each storm, and the average percentage of shrinkage as computed from the various experiments undertaken in each District. The costs per inch-mile are based

on the official fall for each storm, and vary considerably. If, however, the percentage of shrinkage be deducted from the official falls, and the cost per inch-mile be computed on the basis of the number of inches *actually* removed, the results give $470.87 for the first storm, $354.54 for the second, and $358.10 for the third. These figures are very much more in accord with the real expense of removal for each storm.

The experiments on shrinkage were conducted for the purpose of getting as much data as possible bearing on the subject of letting future contracts at a fixed price per inch-mile instead of per cubic yard—the number of inches to be determined by the Weather Bureau reports, with a deduction, constant in character, for percentage of shrinkage. The tabulated results of the investigation appear in detail in a report issued at the close of the season, but are of very little practical use on account of the necessarily limited number of observations and of the narrow range of condition.

CONCLUSION.

In closing I would respectfully call to attention the excellent character of the services rendered the past winter by all the members of the Department on snow work, from the District Superintendents down to the humblest sweeper acting as watcher. The storms of the winter were all heavy, and never before has there been so much snow removed or such speed exhibited. The emergency furnished an excellent opportunity for showing what severe strains can be put upon the present organization of the Department.

Respectfully submitted,

H. L. STIDHAM,

Snow Inspector.

TABLE No. I.

Snow Removed, Winter 1896–1897, *by Days and by Storms.*

Day.	First Storm.		Second Storm.		Third Storm.	
	Date.	Cubic Yards.	Date.	Cubic Yards.	Date.	Cubic Yards.
First	Dec. 16	14,521½	Jan. 28	30,948	Feb. 12	34,380
Second	" 17	40,530	" 29	65,971½	" 13	77,571
Third	" 18	47,527½	" 30	71,037	" 14	83,659½
Fourth	" 19	37,156½	" 31	53,512½	" 15	67,171½
Fifth	" 20	4,186½	Feb. 1	57,964½	" 16	44,607
Sixth	" 22	20,722½	" 2	39,583½	.....	.....
Seventh	" 23	38,146½	" 3	8,152½	.....	.....
Eighth	" 24	36,121½	.....	.....	.....	.....
Ninth	" 26	35,860½	.....	.....	.....	.....
Tenth	" 27	9,129	.....	.....	.....	.....
Eleventh	" 28	30,973½	.....	.....	.....	.....
Twelfth	" 29	32,773½	.....	.....	.....	.....
Thirteenth	" 30	31,216½	.....	.....	.....	.....
Fourteenth	" 31	14,446½	.....	.....	.....	.....
Totals	.....	393,312	.....	327,169½	.....	307,389
Melting machines	.....	942	.....	4,150	.....	2,800½
Grand total	.....	394,254	.....	331,319½	.....	310,189½

SUMMARY.

Storm of December 16 to December 31, inclusive.	394,254	cubic yards.
" January 28 to February 3, inclusive...	331,319½	"
" February 12 to February 16, inclusive..	310,189½	"
Total for winter.....	1,035,763	"
Cubic yards actually dumped or melted.....	1,035,422½	"
Cubic yards removed from loading stations, but not dumped into the river, and so not paid for	340½	cubic yards.

TABLE NO. II.

Comparison of Work of Districts by Storms, Winter 1896–1897.

District.	Total Cubic Yards.			Total Mileage.		
	Dec. 16 to Dec. 31.	Jan. 28 to Feb. 3.	Feb. 12 to Feb. 16.	Dec. 16 to Dec. 31.	Jan. 28 to Feb. 3.	Feb. 12 to Feb. 16.
First	64,387½	56,278½	53,560½	24.91	27.79	27.07
Second	67,996½	58,137	58,258½	38.43	32.65	35.70
Third	52,825½	45,756	39,169½	18.38	20.61	19.59
Fourth	59,607	51,146½	41,680½	18.25	21.47	19.26
Fifth	53,274	48,471	43,053	15.34	16.83	15.01
Sixth	41,860½	26,617½	22,110	13.25	12.81	10.66
Seventh	8,791½	Boulevard Cleared by Scraping.	Boulevard Cleared by Scraping.	3.56	2.75	2.75
Eighth	1,414½	.....	.....	.78	.....	.....
Ninth	11,974½	8,859	11,463	2.48	2.60	2.62
Tenth	23,017½	22,867½	27,949½	5.24	7.70	8.00
Eleventh	9,105	13,186½	12,945	3.77	3.76	3.76
Totals	394,254	331,319½	310,189½	144.39	148.97	144.42

TABLE NO. III.

Recapitulation of District Work, Winter 1896–1897.

District.	Cubic Yards Removed for Entire Winter.	Mileage for Entire Winter.	Average Number Cubic Yards Removed per Mile of Street Cleared.
First	174,226½	79.77	2,184.1
Second	184,392	106.78	1,726.8
Third	137,751	58.58	2,351.5
Fourth	152,434	58.98	2,584.5
Fifth	144,798	47.18	3,069.1
Sixth	90,588	36.72	2,467.0
Seventh	8,791½	9.06*	2,469.5
Eighth	1,414½	.78	1,813.5
Ninth	32,296½	7.70	4,194.3
Tenth	73,834½	20.94	3,526.0
Eleventh	35,236½	11.29	3,121.0
Totals	1,035,763	437.78	2,396.0

* Only 3.56 miles of this were cleared by carting 8,791½ cubic yards; the remaining mileage was cleared by scraping.

TABLE No. IV.

Mileage of Contractor, Street Railways and Melting Machines. Winter 1896–1897.

By Whom Cleared.	Storm Dec. 16 to Dec. 31.	Storm Jan. 28 to Feb. 3.	Storm Feb. 12 to Feb. 16.
G. M. Furman	135.68 miles	133.66 miles	129.86 miles
Metropolitan Traction Co.	3.08 "	3.89 "	3.93 "
Metropolitan Street Railway Co.	.81 "	.81 "	.81 "
D. D., E. B. and B. Railway Co.	4.02 "	3.19 "	2.60 "
Third Avenue Railway Co.	.45 "	2.39 "	2.29 "
Central Crosstown Railway Co	.....	.37 "	.37 "
Second Avenue Railway Co.	.05 miles	.28 "	.28 "
Union Railway Co.	.....	.31 "	.31 "
Melting Machines	.30 miles	1.32 "	1.22 "
Scraped on Boulevard	.....	2.75 "	2.75 "
Totals	144.39 miles	148.97 miles	144.42 miles

TABLE No. V.

Cost Per Inch-Mile in Each Storm, Winter 1896–1897.

Storm.	Official Fall.	Mileage Cleared By Contract.	Total Contract Cost.	Cost Per Inch-mile.	Computed Shrinkage.	Mean Temperature.
Dec. 16 to Dec. 31.	12.6 in.	135.98	$165,586 68	$96.64	79.5%	26°.7F
Jan. 28 to Feb. 3 .	10 "	134.98	138,301 17	102.46	71.1%	24°.7F
Feb. 12 to Feb. 16.	6½ "	131.08	130,279 59	152.91	57.3%	32°.8F

Average cost per inch-mile per storm equals $117.34.

THE LABOR QUESTION IN THE DEPARTMENT OF STREET CLEANING.

DEPARTMENT OF STREET CLEANING,
NEW YORK, April 5, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—I beg to submit the following report of the operations of the Arbitration System inaugurated by yourself in this Department, for the year ending February 20, 1897.

It will not be necessary to burden you with voluminous statistics of the business transacted by the "Committee of 41" and the "Board of Conference," at their respective meetings; the report will be rather of a narrative character.

Under date of January 7, 1896, you addressed an "unofficial communication to the Employees of the Department of Street Cleaning," reading as follows:

"In order to establish friendly and useful relations between the men in the Working Force and the Officers of the Department, I shall be glad to see an Organization formed among the men for the discussion of all matters of interest.

"This Organization will be represented by five Spokesmen in a 'Board of Conference,' in which the Commissioner will be represented by the General Superintendent, the Chief Clerk, one District Superintendent, one Section Foreman and one Stable Foreman.

"It is suggested that the men who gather at each Section Station and the men at each Stable (with the boardmen from the nearest Dumps), each elect one of their number to represent them in a General Committee of 41 (32 from Section Stations and 9 from Stables), and that this General Committee elect the five Spokesmen by whom it is to be represented in the 'Board of Conference.'

"The General Committee will meet in a room to be provided for them, at 2 P. M. on every Thursday, except the third Thursday of each month. The members will not have their time docked for this. Their meetings will be secret, and they will be expected to discuss with perfect freedom everything connected with their work, their relations with the Commissioner and his subordinates, and all questions of discipline, duties, pay, etc., in which they are interested, or which their Sections, Stables and Dumps may have submitted to them.

"The 'Board of Conference' will meet at 2 P. M. on the third Thursday of each month, or as near to this date as the exigencies of the work will allow.

"The ten members of the 'Board of Conference' will be on a perfect equality. It will establish its own Organization and Rules of Procedure, and will elect one of its members Permanent Chairman and another Permanent Secretary, one of these to be chosen from the five Officers, and another from the five Spokesmen.

"It is hoped that this Board will be able to settle every question that may come up, to the satisfaction of all concerned, because most differences can be adjusted by discussions in which both sides are fairly represented.

"Should any matter arise as to which the Board cannot come to a substantial agreement, the Permanent Chairman and the Permanent Secretary will argue the case before the Commissioner, who will try to reach a fair conclusion upon it."

In conformity with the foregoing call, the Sweepers and Drivers organized the "Committee of 41," representatives being chosen entirely by themselves, which Committee, after several meetings, selected from its number the following named men to represent them in the "Board of Conference:"

Thomas P. Hand, John McKeever, Edward O'Brien, Sweepers, and Edward Hagen and Joseph Clifford, Drivers.

The five members of the "Board of Conference" appointed to represent the Commissioner, were David Donohue, Stable Foreman; Fred L. Stearns, District Superintendent; Conrad Schierbaum, Section Foreman; William Robbins, General Superintendent, and Thomas A. Doe, Chief Clerk.

On February 20, 1896, the "Board of Conference" held its first meeting in a room of the Department at No. 28 Chambers street. Every appointee was present, and in organizing the Board, Thomas P. Hand, Sweeper, was unanimously chosen as Permanent Chairman, and Thomas A. Doe, Chief Clerk, as Permanent Secretary.

From the beginning it was evident that a large number of the men had a very full appreciation of the purpose of the plan. They welcomed it in a manly spirit, and entered heartily into every detail of organization. This was the more strange, in view of the radical change of venue, as it were. A large percentage of the men were members of, and amenable to, organizations which existed in the Department under former administrations, and the influence of false teachings received from falser prophets could not be expected to cease without an effort on the part of those whose success depended upon dissensions which might occur, or which they could create, between the Commissioner and the men, and who were seldom seen by the men, except when they thought an opportunity existed for the collection of tithes. Then it was that they deceived and misled, into serious and embarras-

sing situations, those whose interests they were supposed to have at heart and to protect.

Aside from those identified by membership with these organizations, there were many, not members, who held a latent sympathy with the old system of settling differences by strikes. In fact, it was generally understood that wrongs must be either borne or righted by coercion. Arbitration was looked upon as a far-off theory, applicable, perhaps, at times, somewhere and under certain conditions; but the idea of its adaptation to and adoption by a municipal department of the City of New York, and especially the Department of Street Cleaning, where political preference was the only rule they had ever known, had never entered their minds. In fact, they were warned by skeptics, both outside of the Department and among themselves, to "look out for Waring; this is one of his tricks." That any Commissioner of Street Cleaning, even though he were an "angel," should honestly intend, and honestly endeavor to deal fairly with the rank and file of those under him, was too much to believe. There must, they thought, be some sinister motive behind it.

Gradually, however, the better element among the men did believe in it, and as their faith grew stronger, the malcontents were either converted or thrust out, and slowly, but surely, the "Committee of 41" became a body of earnest and honest co-operators with the Commissioner, toward the mutual confidence so essential for contentment on the part of the men, and without which the best results, from the combined efforts of the Commissioner and themselves, could not be expected.

A very false impression obtains among the public at large, that the men constituting the membership of the Department Sweepers and Drivers are below the average in intelligence and acumen. This is not the case. A glance at the faces of the members of the "Committee of 41" would quickly dispel this illusion. Not all of them have enjoyed the advantages of a scholarly education (although some of them have), but it would be a happy day for this country were the average legislator to display the fairness and judgment of these men who have been chosen by their respective constituents as representatives.

Of course, in the beginning, and while the proposed plan of arbitration was an unknown quantity to the men, and they themselves unknown to each other, deadwood drifted in and disturbing spirits appeared, but, as intimated earlier in the report, this element was soon detected, and, in an orderly manner, eliminated.

Special mention must be made of the character and intelligence of the five members chosen to represent the men on the "Board of Conference." The writer had, in the course of his experience, sat under the parliamentary control of many chairmen, and the comparison between them and the only two Permanent Chairmen of the Board has so far had, is not at all to the disadvantage of the latter. Cushing's, or some other manual, was certainly among the text books used in their educa-

tion. Uniform courtesy, gentlemanly, but firm adherence to parliamentary rules, and a thoroughly impartial performance of the duties of a Chairman characterized them.

The "Committee of 41" has, since its first meeting, met every Thursday, except the third Thursday in each month. Their meetings are with closed doors, and their discussions have, therefore, been free from any surveillance or influence, and, as was intended, entirely private and unrestrained.

Perhaps the best way of explaining the general character of the work is to cite illustrating sample cases. For instance:

Driver "A" of Stable .... has, upon the recommendation of his District Superintendent, and with the knowledge and approval of his Stable Foreman, been punished for the violation of Rule No. 17, which prohibits "deliberately trotting or galloping a horse." This is a very important rule, and without its strict observance the condition of the horses would deteriorate rapidly. The horses are heavily built, and purchased with an eye to the character of work which they will be called upon to perform. Trotting or galloping such a horse for two or three blocks will have a much worse effect than walking him for half a day. Therefore it is that when such a charge is made, it is purely a question of fact, so far as the superior officers are concerned, and in most of such cases the Driver does not know by whom he was reported. But Driver "A" has an explanation to make, and a reason to give for the act complained of. It would not do to allow an argument of all cases to follow, as the officers of the Department would have little else to do than listen to lame excuses and bogus explanations. Driver "A" has now, however, another recourse. He calls upon his representative, and explains the matter to him fully, confirming the same in writing. His representative submits the case at the next meeting of the "Committee of 41," and there the plea of "A" is read and discussed by his colaborers. The reason why the horse was trotting is stated to be that he was a green one recently purchased by the Department, unused to city noises and sights; not yet toned down by legitimate labor; frisky and with spirit enough to make it impossible to restrain him to a continuous walk. All this was not known to the Inspector who reported the case.

The Committee investigates the matter, and after gathering confirmatory testimony on the subject, is persuaded that the man's claim is a just one, and it, therefore, refers the case to the "Board of Conference," with such additional light as it has been able to obtain. This is one, possibly, of numerous cases of like or similar character, which the "Board of Conference" takes up and discusses still further at its meeting. It will be noticed that this Board is so constituted that no matter what the character of the case referred to it by the "Committee of 41" may be, there is always one member representing the Commissioner qualified by his position and experience to judge of its merits.

The man has now taken his case two steps toward the Commis-

sioner, and thus far without the latter's knowledge. To facilitate the quick adjustment of these matters, they are, before being brought to the Board, referred to some Department official who is also a member of the "Board of Conference." This official brings with him to the meeting the result of his informal investigation and copies of the Department records relating to the case. This enables the Board to consider "A's" claim impartially, and also to determine its truthfulness.

After due consideration by the Board, the matter is referred to an official in the Department having charge of such matters, with the recommendation that the fine be remitted, being satisfied that this should be done. By the foregoing process, a budget of papers relating to each case is arranged in chronological order and submitted to the Commissioner, who at a glance can comprehend it from beginning to end, and quickly decide as to its merits. A report of his decision is added to the budget, and transmitted by the Secretary of the "Board of Conference" to the Secretary of the "Committee of 41," and it, among others, is read to the Committee at its next meeting, and at the first opportunity the amount forfeited by "A" is paid to him.

The following case is somewhat different in character:

At one of the Board meetings, a communication was received from the "Committee of 41," calling attention to an ordinance of the city, requiring householders to clear the snow from the gutters in front of their premises, and pointing out the very great saving in expense to the city, which would result were the ordinance enforced. Not only would it be a saving to the city, but it would afford quick relief to the public at crosswalks, which would otherwise be flooded in wet or thawing weather if there were snow on the ground. This matter was carefully considered by the Board, and referred direct to the Commissioner, with the suggestion that he request the assistance of the Police Department. The Commissioner thanked the Committee for their suggestion, and immediately took the matter up.

It might appear at first glance that the machinery, as indicated above, is cumbersome and the process slow. Such, however, is not the case. The system is so precisely arranged that when once a case has been started, it goes along without delay. No case need remain unsettled for a longer time than thirty days after its submission to a representative or to the "Committee of 41" direct, and, as a matter of fact, nearly all the cases are settled in half that time, or less.

The matters referred by the "Committee of 41" to the "Board of Conference" vary in character. They are not all complaints. The Board frequently receives suggestions from the men as to improvements in the Department service, or, perhaps, for some modification or change in a rule. A number of these suggestions have been approved by the Commissioner and adopted, and the service has been benefited thereby. Of course, there are many cases submitted to the "Committee of 41" which are so trivial that they are thrown out of court at once, and never reach even the "Board of Conference." Oc-

casionally, however, a complaint of this character does get through, perhaps inadvertently, and reaches the Board, but there it ends its career.

Of all the cases considered by the "Board of Conference" during its first year, there was but one upon which it could not agree. On this case, the Board was divided evenly, the representatives of the men on one side, and those of the Commissioner on the other. This liability to a deadlock had been anticipated in the original call and provided for; accordingly, the Chairman and Secretary of the Board argued their respective sides of the question before the Commissioner. This case occurring toward the end of the year was a novelty, and as the entire Board were very earnest in their respective convictions, the matter was watched with much interest, it being considered, as it were, a test case.

The Commissioner's decision in the matter was in favor of the complainant, and the fine which had been imposed was remitted. The Commissioner, however, stated in his report that—

"technically, and in accordance with all rules of discipline, the fine was a just one, and should be imposed in all similar cases. At the same time, I cannot avoid the feeling that this violation was made for no improper reason, and perhaps with a laudable desire to help the service; and, in any case, probably the ends of justice and discipline are as fully satisfied by the mental anxiety to which the Driver has been subjected, and the full discussion the subject has received in the 'Committee of 41' and the 'Board of Conference,' as they would be by the enforcement of the penalty. I, therefore, direct that the fine be remitted."

On February 18, 1897, on which day the "Board of Conference" held its regular monthly meeting, it received an invitation from the "Committee of 41" to adjourn to a hall near by for the purpose of participating with the Committee in cedebrating the first anniversary of the organization of the Arbitration System. The invitation was accepted. The Committee also invited other officials of the Department (not members of the Board), including Commissioner Waring, Deputy Commissioner Gibson, Assistant Superintendent Cushing and others; in all over fifty were present at the banquet. Congratulatory speeches were made, and it was evident, from the many expressions of satisfaction on the part of the men, that the System of Arbitration, as outlined above, had been a success, and the expressed sentiment of the men was decidedly in favor of its continuance. They believed that in no other way could the employees feel so contented and confident of protection in their places, so long as they performed their duties faithfully. The celebration was held in a quiet way, without ostentation or desire for publicity. In fact, there were no reporters present, and no notice of it appeared in the press. It was more in the nature of a family gathering, for the purpose of expressing, face to face, to the Commissioner,

the gratification of the men at the satisfactory results of the first year's experience.

The following is a brief statistical statement of the year's work of the "Board of Conference," and relates entirely to cases referred to it by the "Committee of 41," or matters brought up by the members of the Board, representing the men:

Matters explained satisfactorily at the same meeting at which submitted	15
Fines remitted or reduced	22
Fines sustained	13
Suggestions from employees for the comfort and convenience of the men, or for the betterment of the Department service approved and acted upon by the Commissioner	24
Cases considered by the Board, but on which it determined that no action should be taken	14
Employees dismissed, reinstated upon satisfactory evidence that the dismissals were unmerited	8
Employees dismissed, but because of unsatisfactory explanations not reinstated	17
The total number of cases considered by the Board was	124

—an average of over 10 for each meeting.

The Secretary's record of the transactions at the Board meetings comprises over 50,000 words.

The above is in no way connected with the statistics of cases considered, or matters discussed, at the meetings of the "Committee of 41."

During the year the "Committee of 41" considered 345 cases, of which 124 were referred to the "Board of Conference," 221 being settled satisfactorily by itself.

On October 2, 1896, the Sweepers and Drivers held an Outing to which were invited their wives, sisters and sweethearts. At that time there were emphatic expressions by the men of satisfaction with the plan of Arbitration.

The *personnel* of the Board, so far as the representatives of the men are concerned, has changed from time to time. The five members at present are: John J. Ecks, John Marks and Patrick Hayden, Sweepers, and John Moran and John Tyrrell, Drivers.

The original five members appointed to represent the Commissioner are still members of the Board.

One of the original Sweepers on the Board has since been promoted to the position of Section Foreman.

Respectfully,

THOMAS A. DOE, *Chief Clerk,*
Secretary "Board of Conference."

DEPARTMENT OF STREET CLEANING,
NEW YORK, December 31, 1897.

COLONEL GEORGE E. WARING, JR.,
Commissioner of Street Cleaning:

SIR—The working year of the Arbitration System, inaugurated by yourself, in this Department, and consisting of the "Committee of 41" and the "Board of Conference," will not end until February 20, 1898.

I have thought it well, however, to make a brief report up to and including December 31, 1897, after which date the new City Charter will go into effect.

As my report of the first year's operation of the System explained its objects and the manner in which its business is performed, I need only add that the plan has continued to meet with the hearty approval of the men, and I am sure has increased their confidence in your administration, so far as they themselves are concerned.

The following is a brief statistical statement of the work during the time indicated, and is on the same lines as the statistics given in the first year's report:

Matters explained satisfactorily at the same meeting at which submitted	8
Fines remitted or reduced	77
Fines sustained	21
Suggestions from employees for the comfort and convenience of the men, or for the betterment of the Department service approved and acted upon by the Commissioner	22
Cases considered by the Board, but on which it determined that no action should be taken	68
Employees dismissed, reinstated upon satisfactory evidence that the dismissals were unmerited	53
Employee dismissed, reinstated, conditional, upon an examination as to his physical ability	1
Employees dismissed, but because of unsatisfactory explanations not reinstated	20
The total number of cases considered by the Board was	270

As in the first year, the above statistics of cases considered by the "Board of Conference" are in no way connected with the cases discussed by the "Committee of 41."

During the same length of time, the "Committee of 41" considered 1,102 cases, 842 of which were not referred to the "Board of Conference."

The total of 1,102 considers each individual as one. At times a number of employees joined in one and the same appeal.

If the working year had coincided with the calendar year, I would have been able to give you more particulars.

Respectfully,

THOMAS A. DOE, *Chief Clerk,*
Secretary "Board of Conference."

NOTE.—The action of the Board of Conference was unanimous in all but seven cases, and in none of these was there a combination of the representatives of the men, or of the representatives of the Commissioner.

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